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SECTION 308-07A: Transfer Case — General
Information

1999 F-Super Duty 250-550 Workshop
Manual

DESCRIPTION AND OPERATION

[Procedure revision date: 01/26/2000](#)

Transfer Case

Refer to [Section 308-07B](#).

SECTION 308-07A: Transfer Case — General
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1999 F-Super Duty 250-550 Workshop
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DIAGNOSIS AND TESTING

[Procedure revision date: 01/26/2000](#)

Transfer Case—Manual Shift

Principles of Operation — Manual Shift

Mechanical Shift System

The New Venture NV 271 is a manual shift, part time three piece transfer case. The case is aluminum. The unit is lubricated by a positive-displacement oil pump that channels oil flow through drilled holes in the rear output shaft. The pump turns with the rear output shaft, and allows towing of the vehicle without disconnecting the rear driveshaft.

The input shaft, front output shaft, 4WD indicator switch, breather barb and shift lever are located on the front part of the case. The drain and fill plugs are located on the rear part of the case. The rear output shaft is located in the rear extension housing.

Mechanical Operation

In the 2WD mode, torque from the transmission is transferred to the front input shaft, which in turn drives the output shaft and fifth gear drive shaft that drives the rear axle.

The 2WD to 4X4 HIGH shift is accomplished when the 2WD to 4X4 HIGH shift fork moves the lockup collar to engage the drive sprocket to the rear output shaft. The drive sprocket turns the chain which turns the front output shaft driven sprocket on the front output shaft and the front driveshaft.

The 4X4 HIGH to 4X4 LOW shift is accomplished when the 4X4 HIGH to 4X4 LOW shift fork moves the shift collar to engage the planet carrier to the main shaft. Torque for the input shaft is then transmitted through the sun gear, which then turns the planets. The planets, which are now engaged to the output shaft, provides a reduction.

Neutral

With the shift selector in neutral, no power is transmitted to either the front or the rear. All the planetary gears turn freely with the input shaft, and the chain sprocket floats freely on the output and fifth gear drive shaft.

2-Wheel Drive

When 2WD is selected, the shift collar hub at the center of the front planet slides forward, putting the transfer case into the high speed range (direct drive). The input shaft and the rear output shaft are locked together. This results in direct drive, straight through to the rear drive shaft. In addition, the 4-wheel drive lockup collar is disengaged so none of the 4-wheel drive components turn.

4-Wheel Drive — 4X4 HIGH

In 4X4 HIGH, the front planet remains in the same position as it was in 2WD. The action of the shift lever causes the 4-wheel drive lockup hub to move rearward, locking the chain sprocket to the rear output shaft. This causes both the front and rear wheels to be driven in the high range.

4-Wheel Drive — 4X4 LOW

4X4 LOW allows for maximum pulling capacity. Shifting into 4X4 LOW causes the shift collar hub to move rearward and allows the front planet to lock to the output and fifth gear drive shaft. With the ring gear unable to turn, the planetary gears "walk" around the inside. The result is that the front planet now turns more slowly than the input shaft. Because the front planet is now locked to the output and fifth gear driveshaft, the output shaft now rotates at a slower speed than the input shaft. This action increases the pulling capacity available to the wheels.

Symptom Chart — Manual Shift

Symptom Chart — Manual Shift		
Condition	Possible Sources	Action
<ul style="list-style-type: none">Transfer Case Makes Noise	<ul style="list-style-type: none">Tire or wheel size.	<ul style="list-style-type: none">VERIFY all tires and wheels are the same size and tire pressure is correct.
	<ul style="list-style-type: none">Excessive tire tread wear.	<ul style="list-style-type: none">CHECK tire tread wear to see if there is more than 0.06 inch difference in tread wear between front and rear. EXCHANGE one front and one rear wheel. RE-INFLATE tires to proper specifications.
	<ul style="list-style-type: none">Internal components.	<ul style="list-style-type: none">CYCLE the transmission through all gear positions with the transfer case in 2WD and 4X4 HIGH. If there is noise in the neutral position or in some gears but not others, DIAGNOSE the transmission. If there is noise in all transmission gear positions, OPERATE the transfer case in all positions. If the noise is only present in 4X4 HIGH,




		<p>DISASSEMBLE the transfer case; REFER to Section 308-07B. CHECK the input gear, intermediate, and front output shaft gear for damage. REPAIR or REPLACE as required. If the noise is only present in 4X4 LOW, INSPECT the planet gears and sliding gears for damage. REPAIR or REPLACE as required.</p>
<ul style="list-style-type: none"> Transfer Case Jumps Out of Gear 	<ul style="list-style-type: none"> Shift linkage. 	<ul style="list-style-type: none"> CHECK shift linkage travel. ADJUST linkage to provide complete gear engagement. ADJUST gearshift lever boot.
	<ul style="list-style-type: none"> Loose mounting bolts. 	<ul style="list-style-type: none"> TIGHTEN mounting bolts.
	<ul style="list-style-type: none"> Front and rear driveshaft slip yokes. 	<ul style="list-style-type: none"> LUBRICATE and REPAIR slip yoke as required. TIGHTEN flange yoke attaching nuts to specifications.
	<ul style="list-style-type: none"> Internal components. 	<ul style="list-style-type: none"> DISASSEMBLE the transfer case; REFER to Section 308-07B. INSPECT the sliding clutch hub and gear clutch teeth. REPAIR or REPLACE as required.
<ul style="list-style-type: none"> Locking Hubs Will Not Release 	<ul style="list-style-type: none"> Driveline/vehicle torsional lockup. 	<ul style="list-style-type: none"> DRIVE vehicle in reverse for 10 feet.
	<ul style="list-style-type: none"> Cold ambient temperatures. 	<ul style="list-style-type: none"> DRIVE vehicle for 16 km (10 mi) to warm the axle; then ATTEMPT to disengage the hub locks.

<ul style="list-style-type: none"> • Driveline/Torsional Windup (Vehicle Hop, Wheel/Tire Bounce, Vehicle Skip) 	<ul style="list-style-type: none"> • Tire inflation pressure. • Tire and wheel size. 	<ul style="list-style-type: none"> • VERIFY all tires and wheels are the correct size and that inflation pressures are correct.
<ul style="list-style-type: none"> • Delayed Shifts to 2WD 	<ul style="list-style-type: none"> • Driveline/torsional windup. 	<ul style="list-style-type: none"> • PLACE the transmission in neutral. RAISE and SUPPORT the vehicle; REFER to Section 100-02. Torsional windup will be released when the wheels are free to rotate and transfer case will complete the shift.
	<ul style="list-style-type: none"> • Cold ambient temperatures. 	<ul style="list-style-type: none"> • DRIVE vehicle for 16 km (10 mi) to warm the axle; then ATTEMPT to disengage the hub locks.
<ul style="list-style-type: none"> • Buzz/Rattle Noise in Transfer Case Shift Lever When the Engine Is Above 1500 RPM 	<ul style="list-style-type: none"> • Powertrain vibration transferred to shift lever. 	<ul style="list-style-type: none"> • CHECK attaching nuts and bolts. TIGHTEN to proper specifications. If buzz/rattle still persists, REMOVE the transfer case shift lever. CHECK the vehicle for buzz/rattle noise with shifter removed. If buzz/rattle persists, CHECK elsewhere for the source of noise. If buzz/rattle is no longer present, REPLACE the transfer case shift lever and control rod connecting the shifter to the transfer case.

Transfer Case—Electronic Shift on the Fly (ESOF)

Refer to Wiring Diagrams Cell 34 ([F-53 Motorhome Chassis](#), [F-Super Duty 250-550](#)), Electric Shift Control for schematic and connector information.

Refer to Wiring Diagrams Cell 59 ([F-53 Motorhome Chassis](#), [F-Super Duty 250-550](#)), Generic Electronic Module for schematic and connector information.

Special Tool(s)	
 ST1137-A	73 Digital Multimeter 105-R0051 or equivalent
 ST1217-A	New Generation STAR (NGS) Tester 418-F048 (007-00500) or equivalent
 ST1176-A	Vacuum Pump 014-R1054 or equivalent

Principles of Operation — Electronic Shift on the Fly

Transfer Case — Electronic Shift on the Fly

The four-wheel drive electronic shift on the fly feature electrically shifts the vehicle transfer case between 2WD, 4X4 HIGH, and 4X4 LOW. The system mode is selected by the operator through a three-position rotary switch on the instrument panel. The operator is informed which mode the system is in by two cluster indicator lamps, one for 4WD HIGH, and one for 4WD LOW (in 4WD LOW, both the lamps are on). Shifts into 4X4 HIGH can be made at any speed. When shifting into or out of LOW range, the generic electronic module (GEM) requires that the vehicle speed be less than 5 km/h (3 mph), the brake applied, and the transmission in NEUTRAL (A/T) or the clutch pedal

be depressed (M/T). (The digital transmission range (TR) sensor informs the GEM when the transmission is in the NEUTRAL range position.)

The electronic shift motor is mounted externally on the transfer case. It drives a rotary cam which moves the mode fork and the range fork within the transfer case between the 4X4 HIGH, 4X4 LOW, and 2WD range positions.

The 4X4 shift motor uses two relays which, under control of the GEM, shift the transfer case shift motor between 4X4 HIGH, 4X4 LOW, and 2WD modes.

The GEM accomplishes shifts system modes by interpreting inputs from:

- 4X4 selector switch.
- Vehicle speed signal (transmitted from the ABS system).
- Transfer case.
- Brake switch.
- Digital transmission range (TR) sensor (automatic transmission).
- Clutch pedal position switch (manual transmission).
- Ignition switch.

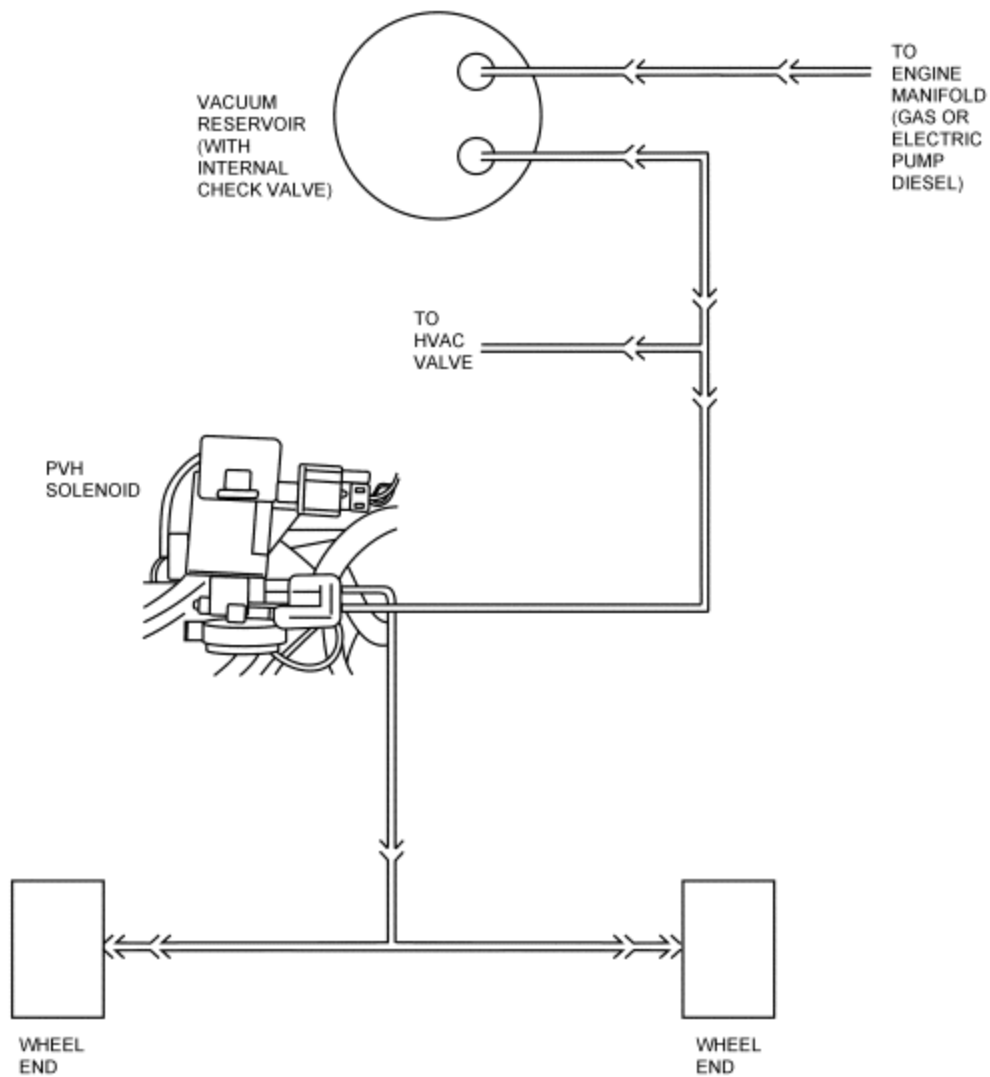
Based on these inputs, the GEM controls the shifts into 2WD, 4X4 HIGH, or 4X4 LOW with the following outputs:

- Low to high relay.
- High to low relay.
- Vacuum hub lock solenoid.
- Transfer case shift motor.

The ESOF system has a feature which allows the driver to override the vacuum operated hubs. When the front hubs are manually turned to the LOCK position, the hubs are locked at all times, overriding the vacuum operated system. If the front hubs are manually turned to the AUTO FREE position, the hubs can only be locked by turning the 4WD mode switch to one of the 4WD positions.

If the front hubs are unable to be unlocked by use of the 4WD mode switch, the hubs may be unlocked by turning the manual locking hub from the AUTO FREE position to the LOCK position and back to AUTO FREE.

Electrical Shift on the Fly (ESOF) Vacuum Schematic



GC1828-B

Inspection and Verification — Electronic Shift on the Fly (ESOF)

1. Verify the customer concern by operating the 2WD/4WD engagement.
2. Visually inspect for the following obvious signs of mechanical and electrical damage.

Visual Inspection Chart	
Mechanical	Electrical
<ul style="list-style-type: none"> • Switch(es) • Transfer case • Hub • Front driveshaft 	<ul style="list-style-type: none"> • Generic electronic module (GEM) • Fuse(s) • PVH solenoid • Damaged wiring harness

<ul style="list-style-type: none"> • Vacuum lines 	<ul style="list-style-type: none"> • Loose or corroded connector(s) • Relay(s) • Circuitry
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3. If the concern remains after the inspection, connect the New Generation STAR (NGS) Tester to the data link connector (DLC) located beneath the instrument panel and select the vehicle to be tested from the NGS menu. If the NGS does not communicate with the vehicle:

- check that the program card is properly installed.
- check the connections to the vehicle.
- check the ignition switch position.

4. If the NGS still does not communicate with the vehicle, refer to the New Generation STAR Tester manual.

5. Perform the DATA LINK DIAGNOSTIC TEST. If the NGS responds with:

- CKT914, CKT915 or CKT70 = ALL ECUS NO RESP/NOT EQUIP, refer to [Section 418-00](#).
- NO RESP/NOT EQUIP for GEM, go to Pinpoint Test E.
- **NOTE:** For vehicles built prior to February 5, 1998, the following criteria must be met when performing the GEM On-Demand Self-Test: headlamps and parklamps must be off and the power windows must be completely up. Failure to meet this criteria will result in DTCs B1577 and B2357 being set. For vehicles built after February 5, 1998, the following criteria must be met when performing the GEM On-Demand Self-Test: headlamps and parklamps must be on. Failure to meet this criteria will result in DTC B1575 being set.

SYSTEM PASSED, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs and perform self-test diagnostics for the GEM.

6. If the DTCs retrieved are related to the concern, go to the GEM Diagnostic Trouble Code (DTC) Index to continue diagnostics.

7. If no DTCs related to the concern are retrieved, proceed to Symptom Chart to continue diagnostics.

GEM Diagnostic Trouble Code (DTC) Index

GEM Diagnostic Trouble Code (DTC) Index			
DTC	Description	DTC Caused By	Action
B1217	Horn Relay Coil Circuit	GEM	REFER to Section 501-14B .

	Failure		
B1218	Horn Relay Coil Circuit Short to Battery	GEM	REFER to Section 501-14B.
B1243	Express Window Down Switch Circuit Short to Battery	GEM	REFER to Section 501-11.
B1300	Power Door Lock Circuit Failure	GEM	REFER to Section 501-14B.
B1302	Accessory Delay Relay Coil Circuit Failure	GEM	REFER to Section 501-11.
B1304	Accessory Delay Relay Coil Circuit Short to Battery	GEM	REFER to Section 501-11.
B1310	Power Door Unlock Circuit Failure	GEM	REFER to Section 501-14B.
B1317	Battery Voltage High	GEM	REFER to Section 414-00.
B1318	Battery Voltage Low	GEM	REFER to Section 414-00.
B1322	Driver Door Ajar Circuit Short to Ground	GEM	REFER to Section 417-02.
B1323	Door Ajar Lamp Circuit Failure	GEM	REFER to Section 413-01.
B1325	Door Ajar Lamp Circuit Short to Battery	GEM	REFER to Section 413-01.
B1330	Passenger Door Ajar Circuit Short to Ground	GEM	REFER to Section 417-02.
B1338	Door Ajar RR Circuit Short to Ground	GEM	REFER to Section 417-02.
B1340	Chime Input Request Circuit Short to Ground	GEM	REFER to Section 413-09.
B1342	ECU is Defective, RAM/ROM Checksum Failure	GEM	CLEAR the DTCs. RETRIEVE the DTCs. If DTC B1342 is retrieved, REPLACE the GEM. REFER to Section 419-10. TEST the system for normal operation.
B1352	Ignition Key-In Circuit Failure	GEM	REFER to Section 413-09.
B1355	Ignition Run Circuit Failure	GEM	REFER to Section 211-05.
B1359	Ignition Run/ACC Circuit Failure	GEM	REFER to Section 211-05.
B1366	Ignition Start Circuit Short to Ground	GEM	REFER to Section 211-05.
B1371	Illuminated Entry Relay	GEM	REFER to Section 417-02.

	Circuit Failure		
B1373	Illuminated Entry Relay Short to Battery	GEM	REFER to Section 417-02.
B1396	Power Door Lock Circuit Short to Battery	GEM	REFER to Section 501-14B.
B1397	Power Door Unlock Circuit Short to Battery	GEM	REFER to Section 501-14B.
B1398	Driver Power Window One Touch Window Relay Circuit Failure	GEM	REFER to Section 501-11.
B1400	Driver Power Window One Touch Relay Circuit Short to Battery	GEM	REFER to Section 501-11.
B1405	Driver Power Window Down Circuit Short to Battery	GEM	REFER to Section 501-11.
B1410	Driver Power Window Motor Circuit Failure	GEM	REFER to Section 501-11.
B1426	Lamp Seat Belt Circuit Short to Battery	GEM	REFER to Section 413-01.
B1428	Lamp Seat Belt Circuit Failure	GEM	REFER to Section 413-01.
B1431	Wiper Brake/Run Relay Circuit Failure	GEM	REFER to Section 501-16.
B1432	Wiper Brake/Run Relay Circuit Short to Battery	GEM	REFER to Section 501-16.
B1434	Wiper Hi/Low Speed Relay Coil Circuit Failure	GEM	REFER to Section 501-16.
B1436	Wiper Hi/Low Speed Relay Coil Circuit Short to Battery	GEM	REFER to Section 501-16.
B1438	Wiper Mode Select Switch Circuit Failure	GEM	REFER to Section 501-16.
B1441	Wiper Mode Select Switch Circuit Short to Ground	GEM	REFER to Section 501-16.
B1446	Wiper Park Sense Circuit Failure	GEM	REFER to Section 501-16.
B1450	Wiper Wash/Delay Switch Circuit Failure	GEM	REFER to Section 501-16.
B1453	Wiper Wash/Delay Switch Circuit Short to Ground	GEM	REFER to Section 501-16.

B1458	Wiper Washer Pump Motor Relay Circuit Failure	GEM	REFER to Section 501-16.
B1460	Wiper Washer Pump Motor Relay Coil Circuit Short to Battery	GEM	REFER to Section 501-16.
B1462	Seat Belt Switch Circuit Failure	GEM	REFER to Section 413-09.
B1473	Wiper Low Speed Circuit Motor Failure	GEM	REFER to Section 501-16.
B1475	Accessory Delay Relay Contact Short to Battery	GEM	REFER to Section 501-11.
B1476	Wiper High Speed Circuit Motor Failure	GEM	REFER to Section 501-16.
B1483	Brake Pedal Input Circuit Failure	GEM	GO to Pinpoint Test B.
B1485	Brake Pedal Input Battery Short	GEM	GO to Pinpoint Test B.
B1574	Door Ajar LR Circuit Short to Ground	GEM	REFER to Section 417-02.
B1577	Lamp Park Input Circuit Short to Battery	GEM	REFER to Section 413-09.
B1840	Wiper Front Power Circuit Failure	GEM	REFER to Section 501-16.
B1982	Driver Door Unlock Relay Circuit Failure	GEM	REFER to Section 501-14B.
B1983	Driver Door Unlock Relay Circuit Short to Battery	GEM	REFER to Section 501-14B.
B2132	Dimmer Switch Circuit Short to Ground	GEM	REFER to Section 417-02.
B2141	NVM Configuration Failure	GEM	CHECK the module configuration. REFER to the NGS Ford Service Function (FSF) card to verify proper module configuration. CLEAR the DTCs. RETRIEVE the DTCs. If DTC B2141 is still present, REPLACE the GEM. REFER to Section 419-10. TEST the system for normal operation.
B2357	Driver Window Down Current Sense Low Circuit Failure	GEM	REFER to Section 501-11.
B2425	Remote Keyless Entry Out of Synchronization	GEM	REFER to Section 501-14B.
C1125	Brake Fluid Level Sensor Input Circuit Failure	GEM	REFER to Section 413-01.

C1182	Park Lamp Flash Relay Circuit Failure	GEM	REFER to Section 501-14B.
C1183	Park Lamp Flash Relay Circuit Short to Battery	GEM	REFER to Section 501-14B.
C1189	Brake Fluid Level Sensor Input Circuit Short to Ground	GEM	REFER to Section 413-01.
C1223	Lamp Brake Warning Output Circuit Failure	GEM	REFER to Section 413-01.
C1225	Lamp Brake Warning Output Circuit Short to Battery	GEM	REFER to Section 413-01.
C1230	Speed Wheel Sensor Rear Center Input Circuit Failure	GEM	REFER to Section 413-01.
C1446	Brake Switch Circuit Failure	GEM	REFER to Section 413-01.
C1728	Transfer Case Unable to Transition Between 2H and 4H	GEM	GO to Pinpoint Test A.
C1729	Transfer Case Unable to Transition Between 4H and 4L	GEM	GO to Pinpoint Test A.
C1751	Vehicle Speed Sensor Number 1 Output Circuit Short to Battery	GEM	REFER to Section 310-03.
C1752	Vehicle Speed Sensor Number 1 Output Circuit Short to Ground	GEM	REFER to Section 310-03.
P0500	Vehicle Speed Sensor (VSS) Malfunction	GEM	GO to Pinpoint Test B.
P1804	Transmission 4-Wheel Drive High Indicator Circuit Failure	GEM	GO to Pinpoint Test D.
P1806	Transmission 4-Wheel Drive High Indicator Short Circuit to Battery	GEM	GO to Pinpoint Test D.
P1808	Transmission 4-Wheel Drive Low Indicator Circuit Failure	GEM	GO to Pinpoint Test D.
P1810	Transmission 4-Wheel Drive Low Indicator Short Circuit to Battery	GEM	GO to Pinpoint Test D.

P1812	Transmission 4-Wheel Drive Mode Select Circuit Failure	GEM	GO to Pinpoint Test A.
P1815	Transmission 4-Wheel Drive Mode Select Short Circuit to Ground	GEM	GO to Pinpoint Test A.
P1819	Transmission Neutral Safety Switch Short Circuit to Ground	GEM	GO to Pinpoint Test B.
P1820	Transmission Transfer Case Clockwise Shift Relay Coil Circuit Failure	GEM	GO to Pinpoint Test A.
P1822	Transmission Transfer Case Clockwise Shift Relay Coil Short to Battery	GEM	GO to Pinpoint Test A.
P1828	Transfer Case Counterclockwise Shift Relay Coil Circuit Failure	GEM	GO to Pinpoint Test A.
P1830	Transmission Transfer Case Counterclockwise Shift Relay Coil Short Circuit to Battery	GEM	GO to Pinpoint Test A.
P1832	Transmission Transfer Case Differential Lockup Solenoid Circuit Failure	GEM	GO to Pinpoint Test C.
P1834	Transmission Transfer Case Differential Lockup Solenoid Short Circuit to Battery	GEM	GO to Pinpoint Test C.
P1838	Transmission Transfer Case Shift Motor Circuit Failure	GEM	GO to Pinpoint Test A.
P1865	Transmission Transfer Case Contact Plate Power Short to Ground	GEM	GO to Pinpoint Test A.
P1866	Transmission Transfer Case System Concern — Servicing Required	GEM	GO to Pinpoint Test A.
P1867	Transmission Transfer Case Contact Plate General Circuit Failure	GEM	GO to Pinpoint Test A.
P1876	Transmission Transfer Case 2-Wheel Drive	GEM	GO to Pinpoint Test C.

	Solenoid Circuit Failure		
P1877	Transmission Transfer Case 2-Wheel Drive Solenoid Circuit Short to Battery	GEM	GO to Pinpoint Test C.

GEM Parameter Identification (PID) Index

GEM Parameter Identification (PID) Index		
PID	Description	Expected Values
ACCDLY	Accessory Delay Relay Circuit	ON, OFF
BOO_GEM	Brake Input Switch Status	ON, OFF
CLTCHSW	Transmission Clutch Interlock Switch	notEGD, ENGAGD
D_DN_SW	Driver Window Down Switch	OFF, DOWN
D_PWRLY	Driver Power Window Status	ON---, OFF---
D_PWAMP	Driver Power Window Motor Current	0.25 to 63.75 amps
DRAJR_L	Door Ajar Warning Lamp Status	ON---, OFF---
D_DR_SW	Left External Access Ajar Switch Status	CLOSED, AJAR
D_SBELT	Driver Seat Belt Status	IN, OUT
IGN_GEM	Ignition Switch Status	START, RUN, OFF, ACCY
IGN_KEY	Ignition Key In/Out	IN, OUT
MTR_CCW	Transmission Transfer Counter CW Motor Output	ON---, OFF---
MTR_CW	Transmission Transfer Clockwise Motor Output	ON---, OFF---
NTRL_SW	Neutral Safety Switch Input	NTRL, notNTRL
OTD_SW	Left Front Power Window One Touch Down Status	OFF, DOWN
P_DR_SW	Right External Access Ajar Switch Status	CLOSED, AJAR
RRDR_SW	Right Rear Door Ajar Switch	CLOSED, AJAR
LRDR_SW	Left Rear Door Ajar Switch	CLOSED, AJAR
PRK_BRK	Park Brake Switch Status	ON, OFF
BRKLAMP	Brake Warning Lamp Status	ON---, OFF---
FLUID_1	Brake Fluid Level Switch #1 Status	ON, OFF
FLUID_2	Brake Fluid Level Switch #2 Status	ON, OFF

PLATE_A	Transmission Transfer Case Contact Plate A	OPEN, CLOSED
PLATE_B	Transmission Transfer Case Contact Plate B	OPEN, CLOSED
PLATE_C	Transmission Transfer Case Contact Plate C	OPEN, CLOSED
PLATE_D	Transmission Transfer Case Contact Plate D	OPEN, CLOSED
PLATEPW	Transmission Transfer Case Contact Plate Pull	ON---, OFF---
SBLTLMP	Seat Belt Lamp Circuit	ON---, OFF---
VBATGEM	Battery Voltage	0.0 VDC-25.5 VDC
VSS_GEM	Vehicle Speed Input	0-255 MPH
WASH_SW	Washer Pump Switch	ON, OFF
WPHISP	Windshield Wiper HI/LO Speed Relay	ON---, OFF---
WPMODE	Windshield Wiper Control Mode Select	WASH, OPEN, OFF, INTVL 1-7, LOW, HIGH
WPRUN	Wiper Motor Run Relay Driver State	ON---, OFF---
2WDSOL	2WD Hub Lock Solenoid Output Status	ON---, OFF---
4WDHIGH	4WD High Output State	ON---, OFF---
4WDLOW	4WD Low Output State	ON---, OFF---
4WD_SW	4WD Input Switch Status	2WD, 4WD LOW, 4WD HIGH, OPEN, GSHORT
4WDSOL	4WD Hub Lock Solenoid Output Status	ON---, OFF---
IPCHIME	External Chime Request	ON, OFF
PARK_SW	Exterior Lamp Control Input Park Lamps Switch Status	ON, OFF
HDL_DIM	Headlamp Dimmer Switch	ON---, OFF---
PRKFRLY	Park Lamp Flash Relay	ON, OFF
HORNRLY	Horn Control Relay Output Status	ON---, OFF---
DR_UNLK	All Doors Unlock Output Status	ON---, OFF---
DD_UNLK	Driver Door Unlock Output Status	ON---, OFF---
ALL_RLY	All Door Lock Output Status	ON, OFF
INTLMP	Illuminated Entry Relay Circuit	ON---, OFF---
CCNTGEM	Number of Continuous DTCs In GEM	One count per bit

GEM Active Command Index

GEM Active Command		
Active Command	Display	Action

FRONT WINDSHIELD WIPER	WIPER RLY	ON, OFF
FRONT WINDSHIELD WIPER	SPEED RLY	ON, OFF
FRONT WINDSHIELD WIPER	WASH RLY	ON, OFF
WARNING LAMPS AND CHIME	SBLT LAMP	ON, OFF
WARNING LAMPS AND CHIME	CHIME	ON, OFF
WARNING LAMPS AND CHIME	AJAR LAMP	ON, OFF
BATTERY SAVER & COURTESY ENTRY	INT LAMPS	ON, OFF
ONE TOUCH WINDOW DOWN & ACCY DELAY	ACCY RLY	ON, OFF
ONE TOUCH WINDOW DOWN & ACCY DELAY	ONE TOUCH	ON, OFF
DOOR LOCK CONTROL	ALL LOCK	ON, OFF
DOOR LOCK CONTROL	UNLOCK	ON, OFF
DOOR LOCK CONTROL	DD UNLOCK	ON, OFF
TURN SIGNAL AND MARKER LAMPS	PARK LAMPS	ON, OFF
HORN CONTROL	HORN	ON, OFF
4-WHEEL ELECTRONIC SHIFT	CW/CCW	ON, OFF
4-WHEEL ELECTRONIC SHIFT	HIGH LAMP	ON, OFF
4-WHEEL ELECTRONIC SHIFT	LOW LAMP	ON, OFF
INDICATOR LAMP CONTROL	BRK LAMP	ON, OFF
MODULE OPTION CONTENT	SPD WARN	ON, OFF
MODULE OPTION CONTENT	SPD WIPER	ACTIVE, notACT
4WD TRANSFR CASE & INDICATORS	NUBLOCK_L	ON, OFF
4WD TRANSFER CASE & INDICATOR	NUBLOCK_H	ON, OFF






Symptom Chart — Electronic Shift on the Fly (ESOF)

Symptom Chart		
Condition	Possible Sources	Action
<ul style="list-style-type: none"> The Vehicle Does Not Shift Between 2WD and 4WD Modes Correctly 	<ul style="list-style-type: none"> 4WD mode switch. Transfer case shift relays. Contact plate A, B, C, or D. Transfer case shift motor. Circuitry. GEM. Transfer case 	<ul style="list-style-type: none"> GO to Pinpoint Test A.

	mechanism.	
<ul style="list-style-type: none"> The Vehicle Does Not Shift Between 4WD High and 4WD Low Modes Correctly 	<ul style="list-style-type: none"> 4WD mode switch. Neutral safety switch. Brake pedal position (BPP) switch. GEM. Transfer case. Digital transmission range (TR) sensor. Circuitry. 	<ul style="list-style-type: none"> GO to Pinpoint Test B.
<ul style="list-style-type: none"> The Front Axle Is Not Engaging Correctly (Transfer Case Motor Movement and Front Driveshaft OK) 	<ul style="list-style-type: none"> Pulse vacuum hublock (PVH) solenoid. GEM. Circuitry. Vacuum lines. Hub and bearing. 	<ul style="list-style-type: none"> GO to Pinpoint Test C.
<ul style="list-style-type: none"> The 4x4 HIGH or 4x4 LOW Range Indicator Do/Does Not Operate Properly 	<ul style="list-style-type: none"> Bulb. Digital TR sensor. Circuitry. Instrument cluster. GEM. 	<ul style="list-style-type: none"> GO to Pinpoint Test D.
<ul style="list-style-type: none"> No Communication With the Module — Generic Electronic Module 	<ul style="list-style-type: none"> Fuse(s). Circuitry. GEM. Fuse junction panel. 	<ul style="list-style-type: none"> GO to Pinpoint Test E.
<ul style="list-style-type: none"> The Front Axle Engages With the 4 Wheel Drive Hubs in Manual But Not in Automatic 	<ul style="list-style-type: none"> Pulse vacuum hublock (PVH) solenoid. GEM. Circuitry. Vacuum lines. Hub and bearing. 	<ul style="list-style-type: none"> GO to Pinpoint Test D.

Pinpoint Tests — Electronic Shift on the Fly (ESOF)

PINPOINT TEST A: THE VEHICLE DOES NOT SHIFT BETWEEN 2WD AND 4WD MODES CORRECTLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1 CHECK THE IGNITION STATES — MONITOR THE GEM PID IGN_GEM	
1. 	
2.  NGS	
3. 	<p>3 NOTE: If the vehicle is equipped with a manual transmission, depress the clutch pedal while turning the ignition switch to the START position.</p> <p>Monitor the GEM PID IGN_GEM and rotate the ignition switch (11572) through the START, RUN, OFF, and ACC positions.</p>
	<ul style="list-style-type: none"> • Do the PID values agree with the ignition switch positions? <p>→ Yes GO to A2.</p> <p>→ No REFER to Section 417-02.</p>
A2 RETRIEVE THE DIAGNOSTIC TROUBLE CODES (DTCs)	
NOTE: DTC P1838 and DTC P1866 require the GEM keep alive memory (KAM) to be cleared after repairs are completed.	
1. 	1 Retrieve and document continuous DTCs.
2. 	

Clear Continuous DTCs	
<div data-bbox="170 241 276 388" data-label="Image"> </div> <p>GEM On-Demand Self-Test</p>	
	<ul style="list-style-type: none"> • Are any DTCs recorded? <p>→ Yes If DTC B1342, REPLACE the GEM; REFER to Section 419-10. CLEAR the DTCs. TEST the system for normal operation.</p> <p>If DTC P1812, GO to A3 .</p> <p>If DTC P1815, GO to A3 .</p> <p>If DTC P1820, GO to A9 .</p> <p>If DTC P1822, GO to A9 .</p> <p>If DTC P1828, GO to A9 .</p> <p>If DTC P1830, GO to A9 .</p> <p>If DTC P1838, GO to A33 .</p> <p>If DTC P1865, GO to A33 .</p> <p>If DTC P1866, GO to A33 .</p> <p>If DTC P1867, GO to A33 .</p> <p>If DTC C1728, GO to A33 .</p> <p>If DTC C1729, GO to A33 .</p> <p>If DTC P1820, P1828 and P1838 are all retrieved together, GO to A33 .</p> <p>→ No GO to A23.</p>

A3 CHECK THE 4WD MODE SWITCH — MONITOR THE GEM PID 4WD_SW

1



2



2 Monitor the GEM PID 4WD_SW while cycling the 4WD mode switch through 2WD, 4X4 HIGH, and 4X4 LOW.

- Do the GEM PID values agree with the 4WD mode switch positions?

→ Yes
GO to [A9](#).

→ No
GO to [A4](#).

A4 CHECK THE 4WD MODE SWITCH — ALL POSITIONS

1

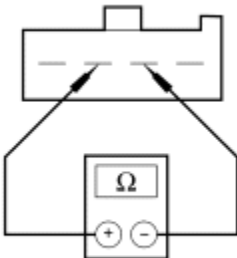


2



4WD Mode Switch 246

3


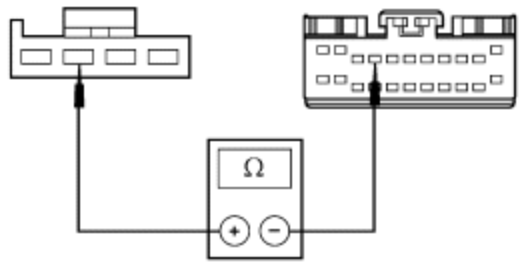


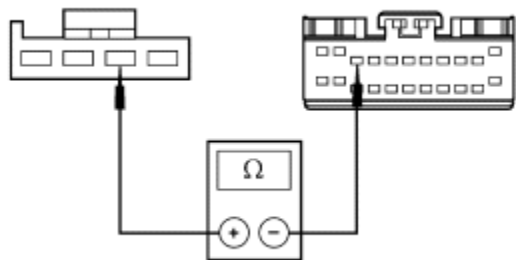
C11929-B

3 Measure the resistance between the 4WD mode switch terminal 2 and terminal 3. Refer to the following chart:

Mode Switch Position	Resistance
2WD	3,700-4,100 Ohms
4X4 HIGH	1,050-1,150 Ohms
4X4 LOW	340-380 Ohms

- Are the resistances within the specified

	<p>values?</p> <p>→ Yes GO to A5.</p> <p>→ No REPLACE the 4WD mode switch; REFER to Section 308-07B. CLEAR the DTCs. TEST the system for normal operation.</p>
A5 CHECK CIRCUIT 465 (W/LB) FOR OPEN	
<p>1</p>  <p>GEM C247</p>	
<p>2</p>  <p>GC1785-A</p>	<p>2 Measure the resistance between 4WD mode switch C246-2, circuit 465 (W/LB), and GEM C247-4, circuit 465 (W/LB).</p>
	<ul style="list-style-type: none"> • Is the resistance less than 5 ohms? <p>→ Yes GO to A6.</p> <p>→ No REPAIR circuit 465 (W/LB). CLEAR the DTCs. TEST the system for normal operation.</p>
A6 CHECK CIRCUIT 780 (DB) FOR OPEN	
<p>1</p>	<p>1 Measure the resistance between 4WD mode switch C246-3, circuit 780 (DB), and GEM C247-3, circuit 780 (DB).</p>



GC1784-A

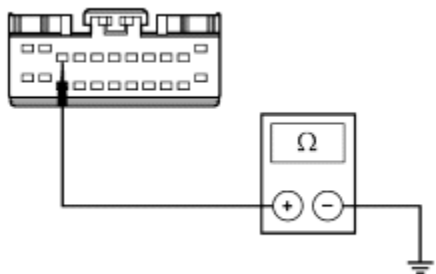
- Is the resistance less than 5 ohms?

→ **Yes**
GO to [A7](#).

→ **No**
REPAIR circuit 780 (DB). CLEAR the DTCs. TEST the system for normal operation.

A7 CHECK CIRCUIT 780 (DB) FOR SHORT TO GROUND

1



GC1843-A

1 Measure the resistance between GEM C247-3, circuit 780 (DB), and ground.

- Is the resistance greater than 10,000 ohms?

→ **Yes**
GO to [A8](#).

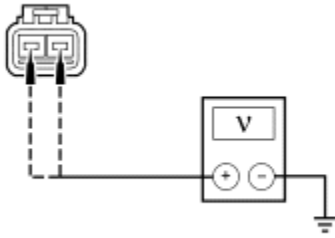
→ **No**
REPAIR circuit 780 (DB). CLEAR the DTCs. TEST the system for normal operation.

A8 CHECK CIRCUIT 780 (DB) FOR SHORT TO POWER

1



<div data-bbox="170 153 203 189" data-label="Text">2</div> <div data-bbox="198 216 626 485" data-label="Diagram"> </div> <div data-bbox="605 501 699 525" data-label="Text">GC1844-A</div>	<div data-bbox="719 153 751 189" data-label="Text">2</div> <div data-bbox="760 153 1401 226" data-label="Text"> <p>Measure the voltage between GEM C247-3, circuit 780 (DB), and ground.</p> </div>
	<div data-bbox="760 615 1148 651" data-label="List-Group"> <ul style="list-style-type: none"> Is any voltage indicated? </div> <div data-bbox="719 688 1401 800" data-label="Text"> <p>→ Yes REPAIR circuit 780 (DB). CLEAR the DTCs. TEST the system for normal operation.</p> </div> <div data-bbox="719 840 1401 984" data-label="Text"> <p>→ No REPLACE the GEM; REFER to Section 419-10. CLEAR the DTCs. TEST the system for normal operation.</p> </div>
A9 CHECK THE VOLTAGE TO THE ELECTRIC SHIFT MOTOR — GEM ACTIVE COMMAND CW/CCW ON	
<div data-bbox="170 1087 203 1123" data-label="Text">1</div> <div data-bbox="168 1123 277 1234" data-label="Image"> </div>	
<div data-bbox="170 1255 203 1291" data-label="Text">2</div> <div data-bbox="168 1291 277 1396" data-label="Image"> </div> <div data-bbox="162 1440 558 1472" data-label="Text">Transfer Case Assembly C284</div>	
<div data-bbox="170 1493 203 1528" data-label="Text">3</div> <div data-bbox="168 1528 277 1633" data-label="Image"> </div>	
<div data-bbox="170 1654 203 1690" data-label="Text">4</div>	<div data-bbox="719 1654 751 1690" data-label="Text">4</div> <div data-bbox="760 1654 1401 1906" data-label="Text"> <p>NOTE: Voltage is only applied to the transfer case assembly for six seconds while the GEM active command CW/CCW is ON.</p> <p>Measure the voltage between transfer case assembly C284, circuit 778 (O), and ground while triggering the GEM active command CW/CCW to ON; and between transfer case</p> </div>



GC1788-A

assembly C284, circuit 777 (Y), and ground while triggering the GEM active command CW/CCW to ON.

- **Are the voltages greater than 10 volts?**

→ **Yes**

GO to [A10](#).

→ **No**

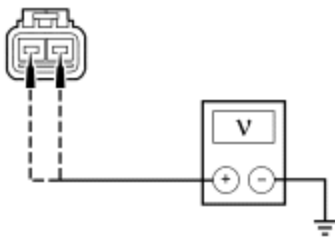
If there is no voltage on circuits 777 (Y) and 778 (O), GO to [A23](#) .

If there is no voltage on circuit 777 (Y) only, GO to [A11](#) .

If there is no voltage on circuit 778 (O) only, GO to [A15](#) .

A10 CHECK THE VOLTAGE TO THE ELECTRIC SHIFT MOTOR — GEM ACTIVE COMMAND CW/CCW OFF

1




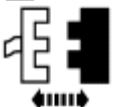

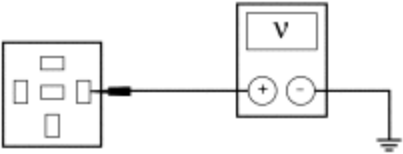
GC1788-A

1 Measure the voltage between transfer case assembly C284, circuit 777 (Y), and ground while triggering the GEM active command CW/CCW to OFF; and between transfer case assembly C284, circuit 778 (O), and ground while triggering the GEM active command CW/CCW to OFF.

- **Are the voltages greater than 10 volts?**

→ **Yes**

If there is voltage on circuit 777 (Y) only, GO to [A19](#) .

	<p>If there is voltage on circuit 778 (O) only, GO to A21.</p> <p>→ No GO to A23.</p>
A11 CHECK THE VOLTAGE TO THE TRANSFER CASE HIGH TO LOW SHIFT RELAY — CIRCUIT 704 (DG/LG)	
<p>1</p> 	
<p>2</p>  <p>Transfer Case High to Low Shift Relay C254</p>	
<p>3</p> 	
<p>4</p>  <p>GN1438-A</p>	<p>4 Measure the voltage between transfer case high to low shift relays C254-86, circuit 704 (DG/LG), and ground.</p>
	<ul style="list-style-type: none"> Is the voltage greater than 10 volts? <p>→ Yes GO to A12.</p> <p>→ No REPAIR circuit 704 (DG/LG). CLEAR the DTCs. TEST the system for normal operation.</p>
A12 CHECK THE TRANSFER CASE HIGH TO LOW RELAY	
<p>1</p>	



2 Check the transfer case high to low shift relay; refer to Component Test.

- **Is the relay OK?**

→ **Yes**
GO to [A13](#).

→ **No**
REPLACE the transfer case high to low relay. TEST the system for normal operation.

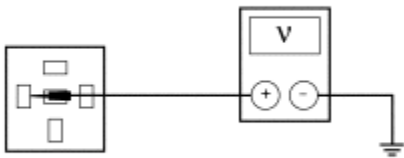
A13 CHECK CIRCUIT 782 (BR/W) FOR SHORT TO POWER



GEM C247



3


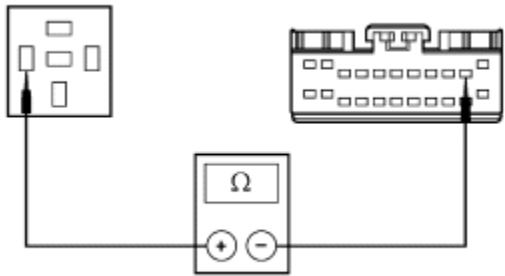




GN1436-A

3 Measure the voltage between transfer case low to high shift relay C255-85, circuit 782 (BR/W), and ground.

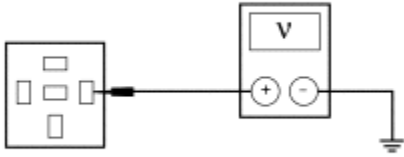
- **Is any voltage indicated?**

→ **Yes**
REPAIR circuit 782 (BR/W). CLEAR the DTCs. TEST the system for normal operation.

	<p>→ No GO to A14.</p>
A14 CHECK CIRCUIT 782 (BR/W) FOR OPEN	
<p>1</p> 	
<p>2</p>  <p>GC1787-A</p>	<p>2 Measure the resistance between transfer case low to high shift relay C255-85, circuit 782 (BR/W), and GEM C247-10, circuit 782 (BR/W).</p>
	<ul style="list-style-type: none"> • Is the resistance less than 5 ohms? <p>→ Yes REPLACE the GEM; REFER to Section 419-10. CLEAR the DTCs. TEST the system for normal operation.</p> <p>→ No REPAIR circuit 782 (BR/W). CLEAR the DTCs. TEST the system for normal operation.</p>
A15 CHECK THE VOLTAGE TO THE TRANSFER CASE LOW TO HIGH SHIFT RELAY — CIRCUIT 704 (DG/LG)	
<p>1</p> 	
<p>2</p>  <p>Transfer Case Low to High Shift Relay C255</p>	
<p>3</p>	



4



GN1438-A

4 Measure the voltage between transfer case low to high shift relay C285-86, circuit 704 (DG/LG), and ground.

- Is the voltage greater than 10 volts?

→ Yes
GO to [A16](#).

→ No
REPAIR circuit 704 (DG/LG). CLEAR the DTCs.
TEST the system for normal operation.

A16 CHECK THE TRANSFER CASE LOW TO HIGH SHIFT RELAY

1



2 Check the transfer case low to high shift relay; refer to Component Test.

- Is the relay OK?

→ Yes
GO to [A17](#).

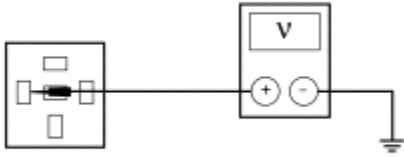
→ No
REPLACE the transfer case low to high shift relay.
TEST the system for normal operation.

A17 CHECK CIRCUIT 781 (O/LB) FOR SHORT TO POWER

1



2



GN1436-A

2 Measure the voltage between transfer case high to low shift relay connector C254-85, circuit 781 (O/LB), and ground.

- Is any voltage indicated?

→ Yes

REPAIR circuit 781 (O/LB). CLEAR the DTCs. TEST the system for normal operation.

→ No

GO to [A18](#).

A18 CHECK CIRCUIT 781 (O/LB) FOR OPEN

1

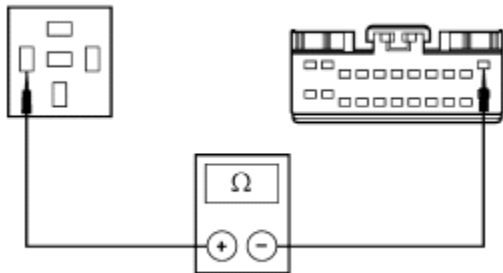


2






GEM C247

3



GC1786-A

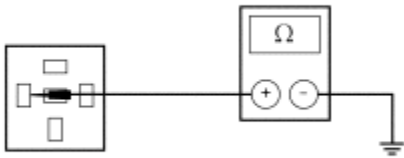
3 Measure the resistance between transfer case shift high to low relay C254-85, circuit 781 (O/LB), and GEM C247-11, circuit 781 (O/LB).

	<ul style="list-style-type: none"> • Is the resistance less than 5 ohms? <p>→ Yes REPLACE the GEM; REFER to Section 419-10. CLEAR the DTCs. TEST the system for normal operation.</p> <p>→ No REPAIR circuit 781 (O/LB). CLEAR the DTCs. TEST the system for normal operation.</p>
A19 CHECK THE TRANSFER CASE HIGH TO LOW SHIFT RELAY	
<div>1</div> 	
<div>2</div>  <p>Transfer Case High to Low Shift Relay C254</p>	
	<div>3</div> Check the transfer case high to low relay; refer to Component Test.
	<ul style="list-style-type: none"> • Is the relay OK? <p>→ Yes GO to A20.</p> <p>→ No REPLACE the transfer case high to low relay. TEST the system for normal operation.</p>
A20 CHECK CIRCUIT 782 (BR/W) FOR SHORT TO GROUND	
<div>1</div>  <p>GEM C247</p>	
<div>2</div>	



Transfer Case High to Low Relay

3



GN1431-A

3 Measure the resistance between transfer case high to low shift relay C254-85, circuit 782 (BR/W), and ground.

- Is the resistance greater than 10,000 ohms?

→ Yes

REPAIR circuit 782 (BR/W). CLEAR the DTCs. TEST the system for normal operation.

→ No

REPLACE the GEM; REFER to [Section 419-10](#). CLEAR the DTCs. TEST the system for normal operation.

A21 CHECK THE TRANSFER CASE LOW TO HIGH SHIFT RELAY

1



2




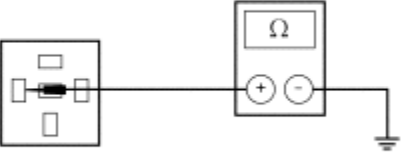


Transfer Case Low to High Shift Relay C255

2 Check the transfer case low to high shift relay; refer to Component Test.



- Is the relay OK?





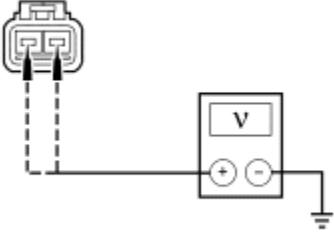
→ Yes


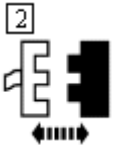

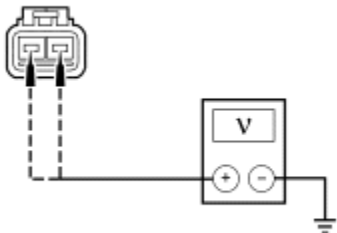
GO to [A22](#).




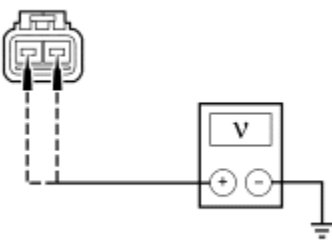
	<p>→ No REPLACE the transfer case low to high shift relay. TEST the system for normal operation.</p>
A22 CHECK CIRCUIT 781 (O/LB) FOR SHORT TO GROUND	
<p>1</p>  <p>GEM C247</p>	
<p>2</p>  <p>GN1431-A</p>	<p>2 Measure the resistance between transfer case high to low shift relay C254-85, circuit 781 (O/LB), and ground.</p>
	<ul style="list-style-type: none"> • Is the resistance greater than 10,000 ohms? <p>→ Yes REPAIR circuit 781 (O/LB). CLEAR the DTCs. TEST the system for normal operation.</p> <p>→ No REPLACE the GEM; REFER to Section 419-10. CLEAR the DTCs. TEST the system for normal operation.</p>
A23 CHECK THE GROUND TO THE CW AND CCW RELAYS — CIRCUITS 57 (BK)	
<p>1</p> 	
<p>2</p>  <p>Transfer Case High to Low Shift Relay</p>	



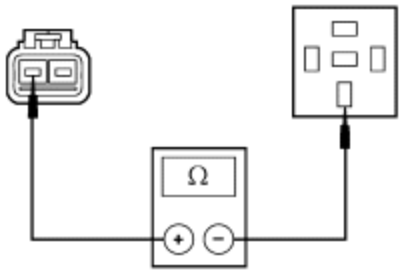

C254	
<div data-bbox="167 205 280 352" data-label="Image"> </div> <p>Transfer Case Low to High Shift Relay C255</p>	
<div data-bbox="167 478 207 520" data-label="Text"> <p>4</p> </div> <div data-bbox="232 604 638 762" data-label="Diagram"> </div> <div data-bbox="605 825 695 856" data-label="Text"> <p>GN1430-A</p> </div>	<div data-bbox="719 478 760 520" data-label="Text"> <p>4</p> </div> <p>Measure the resistance between transfer case low to high shift relay C255-87A, circuit 57 (BK), and ground; and between transfer case high to low shift relay C254-87A, circuit 57 (BK), and ground.</p>
	<ul style="list-style-type: none"> Is the resistance less than 5 ohms? <p>→ Yes GO to A24.</p> <p>→ No REPAIR circuit 57 (BK). CLEAR the DTCs. TEST the system for normal operation.</p>
A24 CHECK THE VOLTAGE TO THE CW AND CCW RELAYS — CIRCUITS 704 (DG/LG)	
<div data-bbox="167 1350 207 1392" data-label="Text"> <p>1</p> </div> <div data-bbox="167 1381 280 1497" data-label="Image"> </div>	
<div data-bbox="167 1518 207 1560" data-label="Text"> <p>2</p> </div> <div data-bbox="232 1644 638 1791" data-label="Diagram"> </div> <div data-bbox="605 1854 695 1885" data-label="Text"> <p>GN1439-A</p> </div>	<div data-bbox="719 1518 760 1560" data-label="Text"> <p>2</p> </div> <p>Measure the voltage between transfer case low to high shift relay C255-87, circuit 704 (DG/LG), and ground; and between transfer case high to low shift relay C284-87, circuit 704 (DG/LG), and ground.</p>

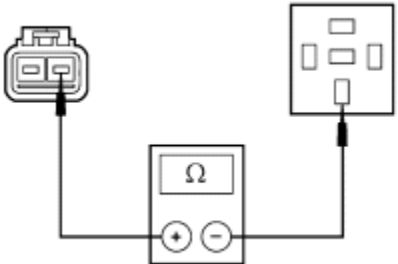


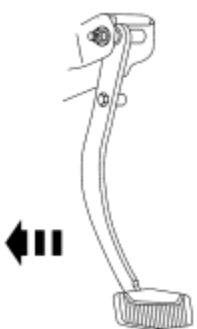
	<ul style="list-style-type: none"> • Is the voltage greater than 10 volts? <p>→ Yes GO to A25.</p> <p>→ No REPAIR circuit 704 (DG/LG). CLEAR the DTCs. TEST the system for normal operation.</p> <p>If both circuits have no voltage, GO to A53 .</p>
A25 CHECK THE FRONT DRIVESHAFT ENGAGEMENT	
<div>1</div> 	
	<div>2</div> Place the 4WD mode switch in 4X4 HIGH and drive a short distance.
	<div>3</div> Raise and support the vehicle; refer to Section 100-02 .
<div>4</div> 	
	<div>5</div> NOTE: The front and rear driveshafts should both spin. Observe the front and rear driveshafts.
	<ul style="list-style-type: none"> • Does the transfer case lock the front driveshaft to the rear driveshaft? <p>→ Yes GO to A26.</p> <p>→ No GO to A27.</p>
A26 CHECK THE FRONT DRIVE SHAFT DISENGAGEMENT	
	<div>1</div> Place the 4WD mode switch in the 2WD position.
<div>2</div>	



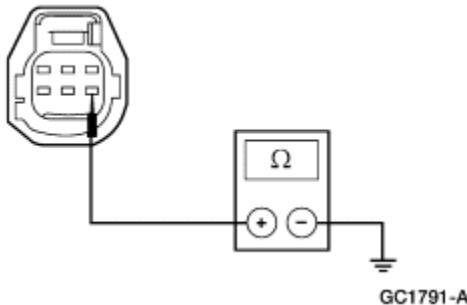
	
	<p>3 Observe the front and rear driveshaft.</p>
	<ul style="list-style-type: none"> Does only the rear driveshaft spin? <p>→ Yes GO to Pinpoint Test C.</p> <p>→ No GO to A27.</p>
<p>A27 CHECK THE VOLTAGE TO THE ELECTRIC SHIFT MOTOR — MOTOR ON</p>	
<p>1</p> 	
<p>2</p>  <p>Transfer Case Assembly C284</p>	
<p>3</p> 	
<p>4</p>  <p>GC1788-A</p>	<p>4 NOTE: Voltage is only applied to the transfer case shift motor for six seconds while the GEM active command CW/CCW is ON.</p> <p>Measure the voltage between transfer case assembly C284, circuit 778 (O), and ground while triggering the GEM active command CW/CCW to ON; and between transfer case assembly C284, circuit 777 (Y), and ground while triggering the GEM active command CW/CCW to ON.</p>
	<ul style="list-style-type: none"> Are the voltages greater than 10 volts? <p>→ Yes GO to A29.</p>


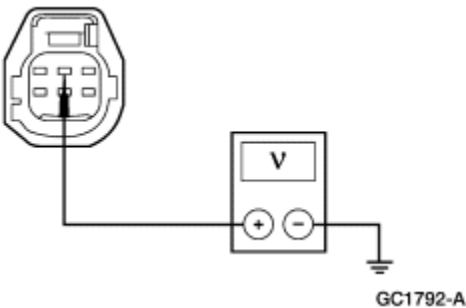

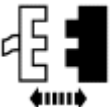
	<p>→ No GO to A28.</p>
A28 CHECK THE TRANSFER CASE SHIFT RELAYS	
<p>1</p> 	
<p>2</p>  <p>Transfer Case Low to High Shift Relay</p>	
<p>3</p>  <p>Transfer Case High to Low Shift Relay</p>	
	<p>4 Check the transfer case shift relays; refer to Component Test.</p>
	<ul style="list-style-type: none"> Are the relays OK? <p>→ Yes GO to A31.</p> <p>→ No REPLACE the relay in question. CLEAR the DTCs. TEST the system for normal operation.</p>
A29 CHECK THE VOLTAGE TO THE ELECTRIC SHIFT MOTOR — MOTOR OFF	
<p>1</p>  <p>GC1788-A</p>	<p>1 Measure the voltage between transfer case assembly C284, circuit 778 (O), and ground while triggering the GEM active command CW/CCW to OFF; and between transfer case assembly C284, circuit 777 (Y), and ground while triggering the GEM active command CW/CCW to OFF.</p>

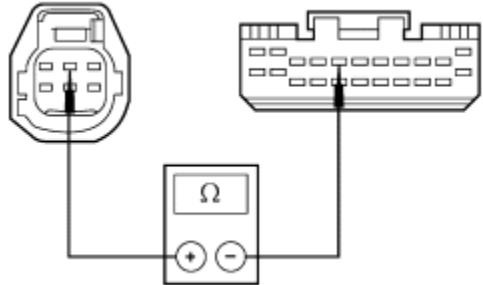


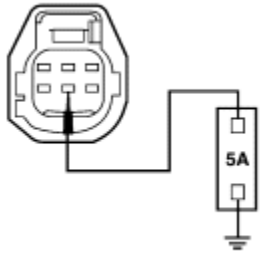
	<ul style="list-style-type: none"> • Are the voltages greater than 10 volts? <p>→ Yes GO to A30.</p> <p>→ No GO to A33.</p>
A30 CHECK CIRCUITS 777 (Y) AND 778 (O) FOR SHORT(S) TO POWER	
<div data-bbox="168 554 201 590" data-label="Text">1</div> 	
<div data-bbox="168 716 201 751" data-label="Text">2</div>  <p>GEM C247</p>	
<div data-bbox="168 953 201 989" data-label="Text">3</div> 	
<div data-bbox="168 1115 201 1150" data-label="Text">4</div>  <p>GC1788-A</p>	<div data-bbox="721 1115 753 1150" data-label="Text">4</div> <p>Measure the voltage between transfer case assembly C284, circuit 778 (O), and ground; and between transfer case assembly C284, circuit 777 (Y), and ground.</p>
	<ul style="list-style-type: none"> • Is any voltage indicated? <p>→ Yes REPAIR circuit 778 (O) or circuit 777 (Y). CLEAR the DTCs. TEST the system for normal operation.</p> <p>→ No REPLACE the transfer case shift relay in question.</p>











	CLEAR the DTCs. TEST the system for normal operation.
A31 CHECK CIRCUIT 777 (Y) FOR OPEN	
<div data-bbox="168 289 201 323" data-label="Text">1</div> 	
<div data-bbox="168 453 201 487" data-label="Text">2</div>  <p>Transfer Case Low to High Shift Relay C255</p>	
<div data-bbox="168 726 201 760" data-label="Text">3</div>  <p>GC1789-A</p>	<div data-bbox="721 726 753 760" data-label="Text">3</div> <p>Measure the resistance between transfer case low to high shift relay C255-30, circuit 777 (Y), and transfer case assembly C284, circuit 777 (Y).</p>
	<ul style="list-style-type: none"> Is the resistance less than 5 ohms? <p>→ Yes GO to A32.</p> <p>→ No REPAIR circuit 777 (Y). CLEAR the DTCs. TEST the system for normal operation.</p>
A32 CHECK CIRCUIT 778 (O) FOR OPEN	
<div data-bbox="168 1549 201 1583" data-label="Text">1</div>  <p>Transfer Case High to Low Shift Relay C254</p>	
<div data-bbox="168 1822 201 1856" data-label="Text">2</div>	<div data-bbox="721 1822 753 1856" data-label="Text">2</div> <p>Measure the resistance between transfer case high to low shift relay C254-30, circuit 778 (O), and</p>

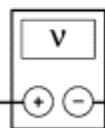
 <p>GC1790-A</p>	<p>transfer case assembly C284, circuit 778 (O).</p>
	<ul style="list-style-type: none"> • Is the resistance less than 5 ohms? <p>→ Yes REPLACE the transfer case motor and sensor assembly. CLEAR the DTCs. TEST the system for normal operation.</p> <p>→ No REPAIR circuit 778 (O). CLEAR the DTCs. TEST the system for normal operation.</p>
<p>A33 CHECK THE CONTACT PLATE SWITCHES — MONITOR THE GEM PLATE PIDS</p>	
<p>1</p> 	<p>1 Monitor the GEM PIDs PLATE_A, PLATE_B, PLATE_C, and PLATE_D.</p>
	<p>2 Place the 4WD mode switch in 2WD and record the GEM PIDs.</p>
	<p>3 Place the 4WD mode switch in 4X4 HIGH and record the PID values.</p>
<p>4</p> 	
<p>5</p>  <p>H9589-A</p>	<p>5 Depress the brake pedal and depress the clutch (M/T) or place the shift lever into NEUTRAL (A/T).</p>

	<div>6</div> Place the 4WD mode switch in 4X4 LOW and record the PID values.																				
	<div>7</div> Compare the PID values with the following table. <table><tr><th>PID</th><th>2WD</th><th>4HIGH</th><th>4LOW</th></tr><tr><td>PLATE_A</td><td>CLOSED</td><td>OPEN</td><td>OPEN</td></tr><tr><td>PLATE_B</td><td>CLOSED</td><td>CLOSED</td><td>OPEN</td></tr><tr><td>PLATE_C</td><td>OPEN</td><td>OPEN</td><td>CLOSED</td></tr><tr><td>PLATE_D</td><td>CLOSED</td><td>CLOSED</td><td>CLOSED</td></tr></table>	PID	2WD	4HIGH	4LOW	PLATE_A	CLOSED	OPEN	OPEN	PLATE_B	CLOSED	CLOSED	OPEN	PLATE_C	OPEN	OPEN	CLOSED	PLATE_D	CLOSED	CLOSED	CLOSED
PID	2WD	4HIGH	4LOW																		
PLATE_A	CLOSED	OPEN	OPEN																		
PLATE_B	CLOSED	CLOSED	OPEN																		
PLATE_C	OPEN	OPEN	CLOSED																		
PLATE_D	CLOSED	CLOSED	CLOSED																		
	<div>• Do the PID values agree with the table?</div> <div>→ Yes</div> <div>REPAIR the transfer case (7A195) or shift motor assembly; REFER to Section 308-07B. CLEAR the DTCs. TEST the system for normal operation.</div> <div>→ No</div> <div>GO to A34.</div>																				
A34 CHECK CIRCUIT 676 (PK/O) FOR OPEN																					
<div>1</div> 																					
<div>2</div>  <div>Transfer Case Assembly C285</div>																					
<div>3</div>  <div>GC1791-A</div>	<div>3</div> Measure the resistance between transfer case assembly C285-4, circuit 676 (PK/O), and ground.																				

	<ul style="list-style-type: none"> • Is the resistance less than 10 ohms? <p>→ Yes GO to A35.</p> <p>→ No REPAIR circuit 676 (PK/O). CLEAR the DTCs. TEST the system for normal operation.</p>
A35 CHECK CIRCUIT 976 (O) FOR BATTERY VOLTAGE	
<p>1</p> 	
<p>2</p> 	<p>2 Measure the voltage between transfer case assembly C285-2, circuit 976 (O), and ground.</p>
	<ul style="list-style-type: none"> • Is the voltage greater than 10 volts? <p>→ Yes GO to A37.</p> <p>→ No GO to A36.</p>
A36 CHECK CIRCUIT 976 (O) FOR OPEN	
<p>1</p> 	
<p>2</p>  <p>GEM C247</p>	

<p>3</p>  <p>GC1793-A</p>	<p>3 Measure the resistance between transfer case assembly C285-2, circuit 976 (O) and GEM C247-5, circuit 976 (O).</p>
	<ul style="list-style-type: none"> Is the resistance less than 5 ohms? <p>→ Yes REPLACE the GEM; REFER to Section 419-10. CLEAR the DTCs. TEST the system for normal operation.</p> <p>→ No REPAIR circuit 976 (O). CLEAR the DTCs. TEST the system for normal operation.</p>
<p>A37 CHECK THE CIRCUIT 771 (P/Y) TO THE CONTACT PLATE SWITCH A — MONITOR THE GEM PID PLATE_A</p>	
<p>1</p> 	<p>1 Monitor the GEM PID PLATE_A.</p>
<p>2</p> 	
<p>3</p>  <p>GC1796-B</p>	<p>3 Connect a fused (5A) jumper wire between transfer case assembly C285-5, circuit 771 (P/Y), and ground.</p>
<p>4</p>	

	
	 Monitor the GEM PID PLATE_A.
	<ul style="list-style-type: none"> • Does the GEM PID PLATE_A indicate CLOSED when the jumper wire is connected and OPEN when the jumper wire is not connected? <p>→ Yes REMOVE the jumper wire; GO to A41 .</p> <p>→ No If the fuse opens or the PID value does not change, GO to A38 .</p>
A38 CHECK CIRCUIT 771 (P/Y) FOR SHORT TO POWER	
 	
 <p>GEM C247</p>	
 	
	 Measure the voltage between transfer case assembly C285-5, circuit 771 (P/Y), and ground.



GC1795-A

- **Is any voltage indicated?**

→ **Yes**

REPAIR circuit 771 (P/Y). CLEAR the DTCs. TEST the system for normal operation.

→ **No**

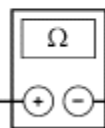
GO to [A39](#).

A39 CHECK CIRCUIT 771 (P/Y) FOR SHORT TO GROUND

1



2



GC1797-A

2 Measure the resistance between transfer case assembly C285-5, circuit 771 (P/Y), and ground.

- **Is the resistance greater than 10,000 ohms?**

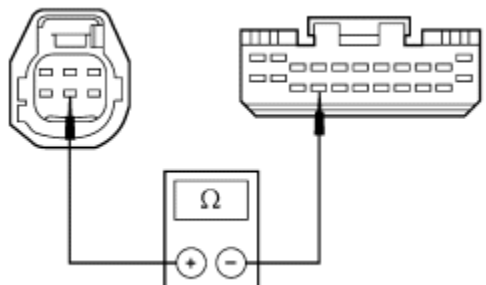


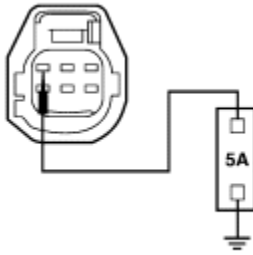
→ **Yes**






GO to [A40](#).

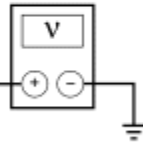
→ **No**

REPAIR circuit 771 (P/Y). CLEAR the DTCs. TEST the system for normal operation.

A40 CHECK CIRCUIT 771 (P/Y) FOR OPEN

<p>1</p>  <p>GC1794-A</p>	<p>1 Measure the resistance between transfer case assembly C285-5, circuit 771 (P/Y), and GEM C247-15, circuit 771 (P/Y).</p>
	<ul style="list-style-type: none"> • Is the resistance less than 5 ohms? <p>→ Yes REPLACE the GEM; REFER to Section 419-10. CLEAR the DTCs. TEST the system for normal operation.</p> <p>→ No REPAIR circuit 771 (P/Y). CLEAR the DTCs. TEST the system for normal operation.</p>
<p>A41 CHECK THE CIRCUIT 764 (BR/W) TO THE CONTACT PLATE SWITCH B — MONITOR THE GEM PID PLATE_B</p>	
<p>1</p> 	<p>1 Monitor the GEM PID PLATE_B.</p>
<p>2</p> 	
<p>3</p>  <p>GC1798-B</p>	<p>3 Connect a fused (5A) jumper wire between transfer case assembly, C285-3, circuit 764 (BR/W), and ground.</p>
<p>4</p>	

	
	<p>5 Monitor the GEM PID PLATE_B.</p>
	<ul style="list-style-type: none"> • Does the GEM PID PLATE_B indicate CLOSED when the jumper wire is connected and OPEN when the jumper wire is not connected? <p>→ Yes GO to A45.</p> <p>→ No If the fuse opens or the PID value does not change, GO to A42 .</p>
A42 CHECK CIRCUIT 764 (BR/W) FOR SHORT TO POWER	
<p>1</p> 	
<p>2</p>  <p>GEM C247</p>	
<p>3</p> 	
<p>4</p>	<p>4 Measure the voltage between transfer case assembly C285-3, circuit 764 (BR/W), and ground.</p>



GC1801-A

- **Is the voltage greater than 10 volts?**

→ **Yes**

REPAIR circuit 764 (BR/W). CLEAR the DTCs.
TEST the system for normal operation.

→ **No**

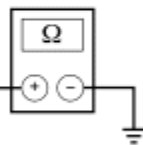
GO to [A43](#).

A43 CHECK CIRCUIT 764 (BR/W) FOR SHORT TO GROUND

1



2



GC1799-A

- 2** Measure the resistance between transfer case assembly C285-3, circuit 764 (BR/W), and ground.

- **Is the resistance greater than 10,000 ohms?**

→ **Yes**

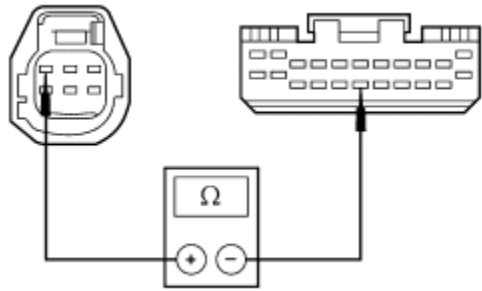
GO to [A44](#).

→ **No**

REPAIR circuit 764 (BR/W). CLEAR the DTCs.
TEST the system for normal operation.

A44 CHECK CIRCUIT 764 (BR/W) FOR OPEN

1



GC1800-A

1 Measure the resistance between transfer case assembly C285-3, circuit 764 (BR/W), and GEM C247-17, circuit 764 (BR/W).

- Is the resistance less than 5 ohms?

→ Yes

REPLACE the GEM; REFER to [Section 419-10](#). CLEAR the DTCs. TEST the system for normal operation.

→ No

REPAIR circuit 764 (BR/W). CLEAR the DTCs. TEST the system for normal operation.

A45 CHECK THE CIRCUIT 770 (W) TO THE CONTACT PLATE SWITCH C — MONITOR THE GEM PID PLATE_C

1

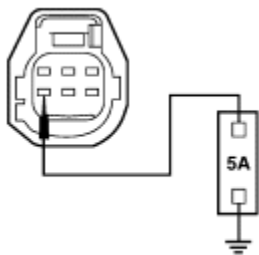


1 Monitor the GEM PID PLATE_C.

2








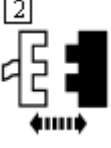




3

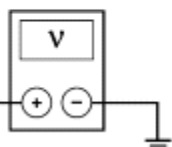


GC1802-B

3 Connect a fused (5A) jumper wire between transfer case assembly C285-6, circuit 770 (W), and ground.

4

	
	 Monitor the GEM PID PLATE_C.
	<ul style="list-style-type: none"> • Does the GEM PID PLATE_C indicate CLOSED when the jumper wire is connected and OPEN when the jumper wire is not connected? <p>→ Yes GO to A49.</p> <p>→ No If the fuse opens or the PID does not change, GO to A46 .</p>
A46 CHECK CIRCUIT 770 (W) FOR SHORT TO POWER	
 	
 <p>GEM C247</p>	
 	
	 Measure the voltage between transfer case assembly C285-6, circuit 770 (W), and ground.



GC1805-A

- **Is any voltage indicated?**

→ **Yes**

REPAIR circuit 770 (W). CLEAR the DTCs. TEST the system for normal operation.

→ **No**

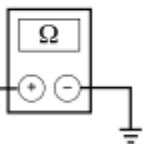
GO to [A47](#).

A47 CHECK CIRCUIT 770 (W) FOR SHORT TO GROUND

1



2



GC1803-A

2 Measure the resistance between transfer case assembly C285-6, circuit 770 (W), and ground.

- **Is the resistance greater than 10,000 ohms?**

→ **Yes**

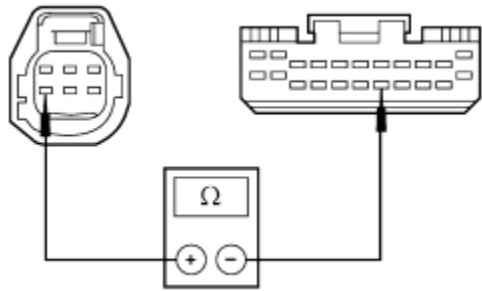
GO to [A48](#).

→ **No**

REPAIR circuit 770 (W). CLEAR the DTCs. TEST the system for normal operation.

A48 CHECK CIRCUIT 770 (W) FOR OPEN

1



GC1804-A

1 Measure the resistance between transfer case assembly C285-6, circuit 770 (W), and GEM C247-18, circuit 770 (W).

- Is the resistance less than 5 ohms?

→ Yes

REPLACE the GEM; REFER to [Section 419-10](#). CLEAR the DTCs. TEST the system for normal operation.

→ No

REPAIR circuit 770 (W). CLEAR the DTCs. TEST the system for normal operation.

A49 CHECK CIRCUIT 763 (O/W) TO THE CONTACT PLATE SWITCH D — MONITOR THE GEM PID PLATE_D

1

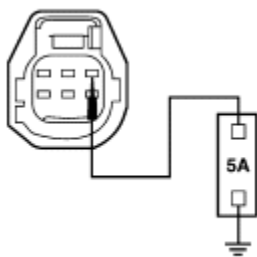


1 Monitor the GEM PID PLATE_D.

2






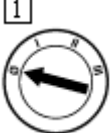
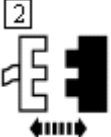



3

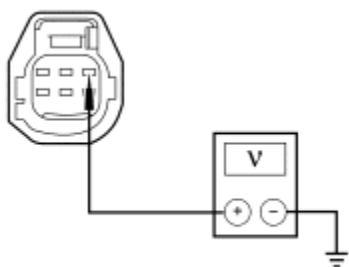


GC1806-B

3 Connect a fused (5A) jumper wire between transfer case assembly C285-1, circuit 763 (O/W), and ground.

4

	
	 Monitor the GEM PID PLATE_D.
	<ul style="list-style-type: none"> Does the PID PLATE_D indicate CLOSED when the jumper wire is connected and OPEN when the jumper wire is not connected? <p>→ Yes REPLACE the transfer case shift motor (7G360); REFER to Section 308-07B. CLEAR the DTCs. TEST the system for normal operation.</p> <p>→ No GO to A50.</p>
A50 CHECK CIRCUIT 763 (O/W) FOR SHORT TO POWER	
	
 <p>GEM C247</p>	
	
	 Measure the voltage between transfer case assembly C285-1, circuit 763 (O/W), and ground.



GC1809-A

- **Is the voltage greater than 10 volts?**

→ **Yes**

REPAIR circuit 763 (O/W). CLEAR the DTCs.
TEST the system for normal operation.

→ **No**

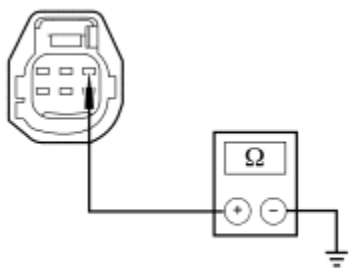
GO to [A51](#).

A51 CHECK CIRCUIT 763 (O/W) FOR SHORT TO GROUND

1



2



GC1807-A

- 2 Measure the resistance between transfer case assembly C285-1, circuit 763 (O/W), and ground.

- **Is the resistance greater than 10,000 ohms?**

→ **Yes**

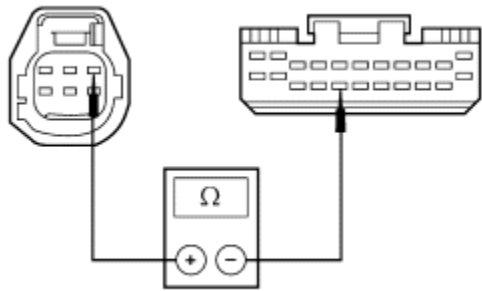
GO to [A52](#).

→ **No**

REPAIR circuit 763 (O/W). CLEAR the DTCs.
TEST the system for normal operation.

A52 CHECK CIRCUIT 763 (O/W) FOR OPEN

1



GC1808-A

1 Measure the resistance between transfer case assembly C285-1, circuit 763 (O/W), and GEM C247-16, circuit 763 (O/W).

- Is the resistance less than 5 ohms?

→ Yes

REPLACE the GEM; REFER to [Section 419-10](#). CLEAR the DTCs. TEST the system for normal operation.

→ No

REPAIR circuit 763 (O/W). CLEAR the DTCs. TEST the system for normal operation.

A53 CHECK POWER DISTRIBUTION BOX FUSE 17 (30A)

1



2



Fuse 17 (30A)

- Is the fuse OK?

→ Yes

GO to [A54](#).

→ No

GO to [A55](#).

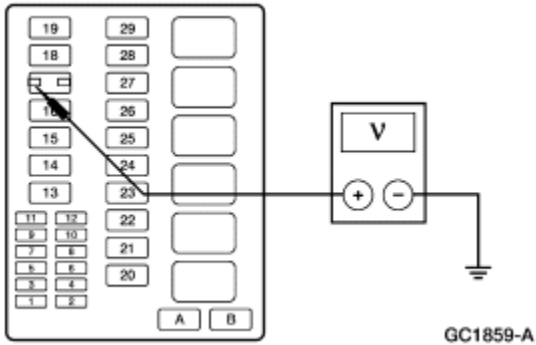
A54 CHECK VOLTAGE AT POWER DISTRIBUTION BOX FUSE 17 (30A)

1



Fuse 17 (30A)

2



2 Measure the voltage between power distribution box fuse 17 (30A) and ground.

- Is the voltage greater than 10 volts?

→ Yes

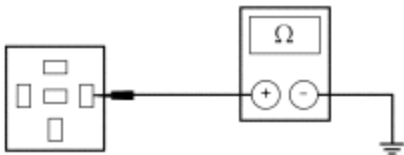
REPAIR circuit 704 (DG/LG). TEST the system for normal operation.

→ No

REPAIR/REPLACE the power distribution box. TEST the system for normal operation.

A55 CHECK CIRCUIT 704 (DG/LG) FOR SHORT TO GROUND

1


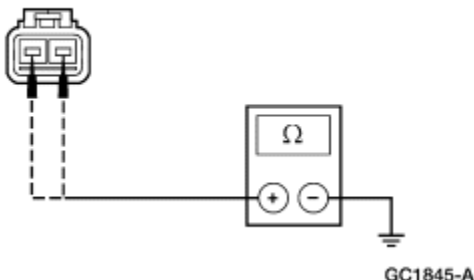


1 Measure the resistance between transfer case high to low relay C254-86, circuit 704 (DG/LB), and ground.






- Is the resistance less than 5 ohms?

→ Yes

REPAIR circuit 704 (DG/LG). TEST the system for normal operation.

	<p>→ No GO to A56.</p>
A56 CHECK CIRCUITS 777 (Y) AND 778 (O) FOR SHORT TO GROUND	
<p>1</p>  <p>Transfer Case Assembly C284</p>	
<p>2</p>  <p>GC1845-A</p>	<p>2 Measure the resistance between transfer case assembly C284, circuit 777 (Y), and ground; and between transfer case assembly C284, circuit 778 (O), and ground.</p>
	<ul style="list-style-type: none"> • Are the resistances less than 5 ohms? <p>→ Yes REPAIR circuits 777 (Y) or 778 (O). CLEAR the DTCs. TEST the system for normal operation.</p> <p>→ No GO to A57.</p>
A57 CHECK THE TRANSFER CASE SHIFT RELAYS	
	<p>1 Check the transfer case shift relays; refer to Component Test.</p>
	<ul style="list-style-type: none"> • Are the relays OK? <p>→ Yes REPLACE the transfer case assembly. CLEAR the DTCs. TEST the system for normal operation.</p> <p>→ No REPLACE the transfer case shift relay(s). CLEAR the DTCs. TEST the system for normal operation.</p>

PINPOINT TEST B: THE VEHICLE DOES NOT SHIFT BETWEEN 4WD HIGH AND 4WD LOW MODES CORRECTLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1 CHECK THE IGNITION STATES — MONITOR THE GEM PID IGN_GEM	
<div>1</div> 	
<div>2</div>  <p>NGS</p>	
<div>3</div> 	<div>3</div> <p>NOTE: If the vehicle is equipped with a manual transmission, depress the clutch pedal while turning the ignition switch to START.</p> <p>Monitor the GEM PID IGN_GEM and rotate the ignition switch through the START, RUN, OFF, and ACC positions.</p>
	<ul style="list-style-type: none"> • Do the PID values agree with the ignition switch positions? <p>→ Yes GO to B2.</p> <p>→ No REFER to Section 417-02.</p>
B2 RETRIEVE THE DIAGNOSTIC TROUBLE CODES (DTCS)	
<div>1</div> 	<div>1</div> <p>Retrieve and document continuous DTCs.</p>
<div>2</div>  <p>Clear Continuous DTCs</p>	
<div>3</div>	



GEM On-Demand Self-Test

- **Are any DTCs recorded?**

→ **Yes**

If DTC B1342, REPLACE the GEM; REFER to [Section 419-10](#). CLEAR the DTCs. TEST the system for normal operation.

If DTC P0500, GO to [B16](#) .

If DTC B1483, GO to [B9](#) .

If DTC B1485, GO to [B21](#) .

If DTC P1812, GO to [B4](#) .

If DTC P1815, GO to [B4](#) .

If DTC P1819, GO to [B13](#) .

→ **No**

GO to [B3](#).

B3 CHECK THE 4WD MODE SWITCH — MONITOR THE GEM PID 4WD_SW



1 Monitor the GEM PID 4WD_SW while cycling the 4WD mode switch through 2WD, 4X4 HIGH, and 4X4 LOW.

- **Do the GEM PID values agree with the switch positions?**

→ **Yes**

GO to [B9](#).

→ **No**

GO to [B4](#).

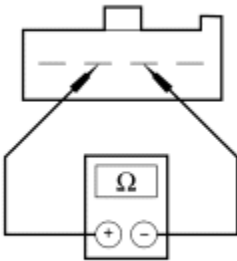
B4 CHECK THE 4WD MODE SWITCH — ALL POSITIONS

1



4WD Mode Switch C246

3



C11929-B

3 Measure the resistance between the 4WD mode switch terminal 2 and terminal 3. Refer to the following chart:

Mode Switch Position	Resistance
2WD	3700-4100 Ohms
4X4 HIGH	1050-1150 Ohms
4X4 LOW	340-480 Ohms

- Are the resistances within the specified values?

→ Yes
GO to [B5](#).

→ No
REPLACE the 4WD mode switch. REFER to [Section 308-07B](#). CLEAR the DTCs. TEST the system for normal operation.

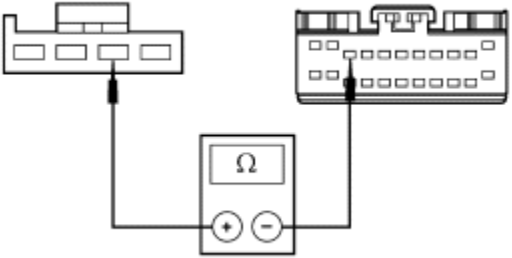
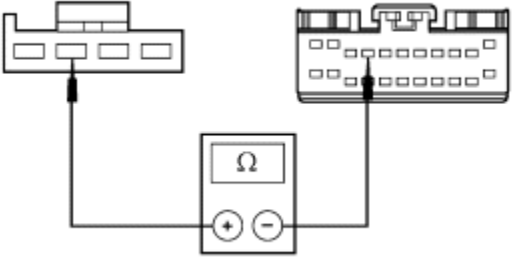
B5 CHECK CIRCUIT 780 (DB) FOR OPEN

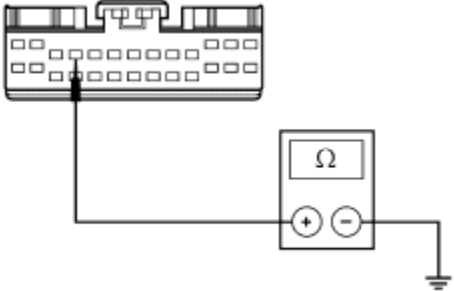

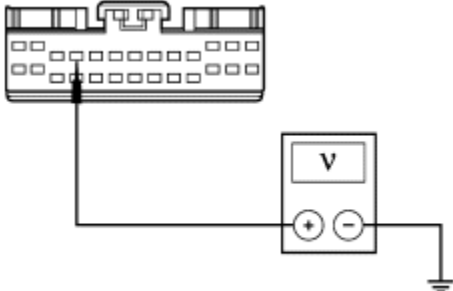




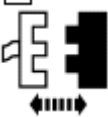
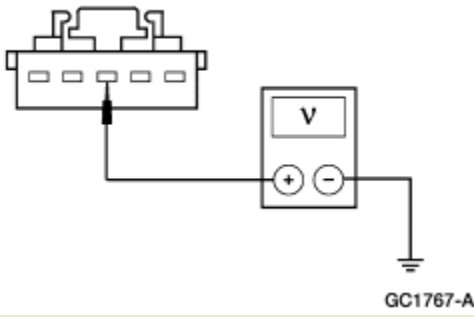
GEM C247


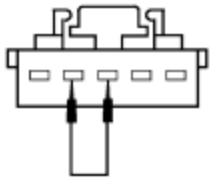

2





2 Measure the resistance between 4WD mode switch C246-3, circuit 780 (DB), and GEM C247-3, circuit 780 (DB).


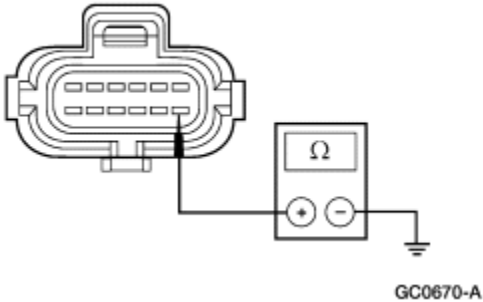


 <p>GC1784-A</p>	
	<ul style="list-style-type: none"> • Is the resistance less than 5 ohms? <p>→ Yes GO to B6.</p> <p>→ No REPAIR circuit 780 (DB). CLEAR the DTCs. TEST the system for normal operation.</p>
B6 CHECK CIRCUIT 465 (W/LB) FOR OPEN	
<p>1</p>  <p>GC1785-A</p>	<p>1 Measure the resistance between 4WD mode switch C246-2, circuit 465 (W/LB), and GEM C247-4, circuit 465 (W/LB).</p>
	<ul style="list-style-type: none"> • Is the resistance less than 5 ohms? <p>→ Yes GO to B7.</p> <p>→ No REPAIR circuit 465 (W/LB). CLEAR the DTCs. TEST the system for normal operation.</p>
B7 CHECK CIRCUIT 465 (W/LB) FOR SHORT TO GROUND	
<p>1</p>	<p>1 Measure the resistance between GEM C247-4, circuit 465 (W/LB), and ground.</p>



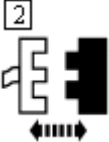

 <p>GC1856-A</p>	
	<ul style="list-style-type: none"> • Is the resistance greater than 10,000 ohms? <p>→ Yes GO to B8.</p> <p>→ No REPAIR circuit 465 (W/LB). CLEAR the DTCs. TEST the system for normal operation.</p>
B8 CHECK CIRCUIT 465 (W/LB) FOR SHORT TO POWER	
<p>1</p> 	
<p>2</p>  <p>GC1857-A</p>	<p>2 Measure the voltage between GEM C247-4, circuit 465 (W/LB), and ground.</p>
	<ul style="list-style-type: none"> • Is any voltage indicated? <p>→ Yes REPAIR circuit 465 (W/LB). CLEAR the DTCs. TEST the system for normal operation.</p> <p>→ No REPLACE the GEM; REFER to Section 419-10. CLEAR the DTCs. TEST the system for normal</p>

	operation.
B9 CHECK BRAKE PEDAL POSITION (BPP) SWITCH INPUT — MONITOR THE GEM PID BOO_GEM	
<div>1</div> 	<div>1</div> Monitor the GEM PID BOO_GEM.
	<div>2</div> Depress the brake pedal.
	<ul style="list-style-type: none"> Does the GEM PID BOO_GEM change states? <p>→ Yes If the vehicle is a manual transmission, GO to B12 .</p> <p>If the vehicle is an automatic transmission, GO to B13 .</p> <p>→ No GO to B10.</p>
B10 CHECK THE VOLTAGE TO THE BPP SWITCH — CIRCUIT 22 (LB/BK)	
<div>1</div> 	
<div>2</div>  <p>BPP Switch C279</p>	
<div>3</div> 	<div>3</div> Measure the voltage between BPP switch C279-3, circuit 22 (LB/BK), and ground.

	<ul style="list-style-type: none"> • Is the voltage greater than 10 volts? <p>→ Yes GO to B11.</p> <p>→ No CHECK fuse junction panel 15 (5A). REPLACE if necessary. If fuse junction panel 15 (5A) is OK, REPAIR circuit 22 (LB/BK). CLEAR the DTCs. TEST the system for normal operation.</p>
B11 CHECK THE BPP SWITCH — MONITOR THE GEM PID BOO_GEM	
<p>1</p> 	<p>1 Verify the GEM PID BOO_GEM displays OFF.</p>
<p>2</p>  <p>GC1768-A</p>	<p>2 Connect a jumper wire between BPP switch C279-3, circuit 22 (LB/BK), and BPP switch C279-2, circuit 810 (R/LG).</p>
<p>3</p> 	<p>3 Monitor the GEM PID BOO_GEM.</p>
	<ul style="list-style-type: none"> • Does the GEM PID display ON? <p>→ Yes REPLACE the BPP switch; REFER to Section 417-01. CLEAR the DTCs. TEST the system for normal operation.</p> <p>→ No REPAIR circuit 810 (R/LG). TEST the system for normal operation. If the concern remains, REPLACE the GEM. REFER to Section 419-10. CLEAR the DTCs. TEST the system for normal operation.</p>
B12 CHECK THE CLUTCH INTERLOCK — MONITOR THE GEM PID CLTCHSW	

	<p>1 Monitor the GEM PID CLTCHSW while depressing the clutch pedal.</p>
	<p>2 Verify the GEM PID CLTCHSW displays ENGAGD.</p>
	<p>3 Release the clutch pedal.</p>
	<p>4 Verify the GEM PID CLTCHSW displays NOT ENGAGD.</p>
	<ul style="list-style-type: none"> • Do the GEM PIDs display correctly? <p>→ Yes GO to B16.</p> <p>→ No DIAGNOSE the starter interrupt circuit; REFER to Section 303-06A or Section 303-06B. CLEAR the DTCs. TEST the system for normal operation.</p>
B13 CHECK THE DIGITAL TR SENSOR — MONITOR THE GEM PID NTRL_SW	
	<p>1 Monitor the GEM PID NTRL_SW.</p>
	
	<p>3 Verify the GEM PID NTRL_SW displays NTRL.</p>
	<p>4 Place the gear selector in every position except neutral.</p>
	<p>5 Verify the GEM PID NTRL_SW displays notNTRL when the transmission is in any position other than NEUTRAL.</p>
	<ul style="list-style-type: none"> • Do the GEM PIDs indicate correctly? <p>→ Yes</p>

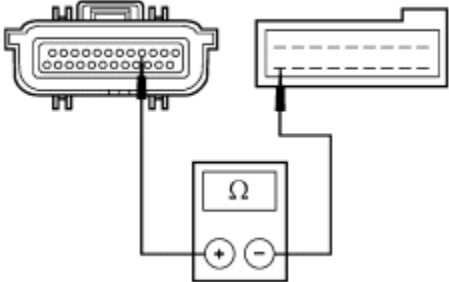
	<p>GO to B16.</p> <p>→ No GO to B14.</p>
B14 CHECK THE GROUND TO THE DIGITAL TRANSMISSION RANGE (TR) SENSOR — CIRCUIT 676 (PK/O)	
<p>1</p>  <p>Digital TR Sensor</p>	
<p>2</p>  <p>GC0670-A</p>	<p>2 Measure the resistance between digital TR sensor C1012-7, circuit 676 (PK/O), and ground.</p>
	<ul style="list-style-type: none"> • Is the resistance less than 5 ohms? <p>→ Yes GO to B15.</p> <p>→ No REPAIR circuit 676 (PK/O). CLEAR the DTCs. TEST the system for normal operation.</p>
B15 CHECK THE DIGITAL TR SENSOR — MONITOR THE GEM PID NTRL_SW	
<p>1</p> 	
<p>2</p> 	<p>2 Monitor the GEM PID NTRL_SW.</p>
	<ul style="list-style-type: none"> • Does the GEM PID NTRL_SW indicate

	<p>NTRL?</p> <p>→ Yes REPAIR circuit 463 (R/W). CLEAR the DTCs. TEST the system for normal operation. If the concern remains, REPLACE the GEM. REFER to Section 419-10. CLEAR the DTCs. TEST the system for normal operation.</p> <p>→ No REPAIR circuit 463 (R/W). TEST the system for normal operation. If the concern remains, REPLACE the digital TR sensor. REFER to Section 307-01. CLEAR the DTCs. TEST the system for normal operation.</p>
B16 CHECK THE VEHICLE SPEED SIGNAL — MONITOR THE GEM PID VSS_GEM	
	<p>1 Monitor the GEM PID VSS_GEM while driving the vehicle from 0 to 88.5 km/h (55 mph).</p>
	<ul style="list-style-type: none"> • Does the GEM PID VSS_GEM agree with the speedometer? <p>→ Yes REPLACE the GEM; REFER to Section 419-10. CLEAR the DTCs. TEST the system for normal operation.</p> <p>→ No GO to B17.</p>
B17 CHECK CIRCUIT 679 (GY/BK) FOR OPEN	
	
 <p>4WABS Control Module C1040</p>	
	



GEM C241

4



GC1810-A

4 Measure the resistance between 4WABS control module C1040-16, circuit 679 (GY/BK), and fuse junction panel C241 terminal 18.

- Is the resistance less than 5 ohms?

→ Yes
GO to [B18](#).

→ No
REPAIR circuit 679 (GY/BK). CLEAR the DTCs.
TEST the system for normal operation.

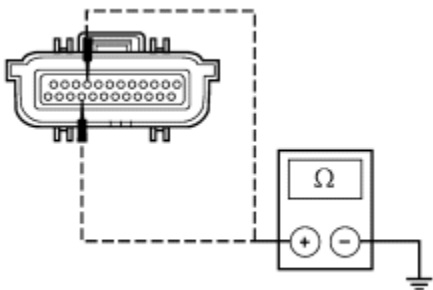
B18 CHECK CIRCUITS 523 (R/PK) AND 519 (LG/BK) FOR SHORT TO GROUND

1



Rear Anti-Lock Brake Sensor C404

2



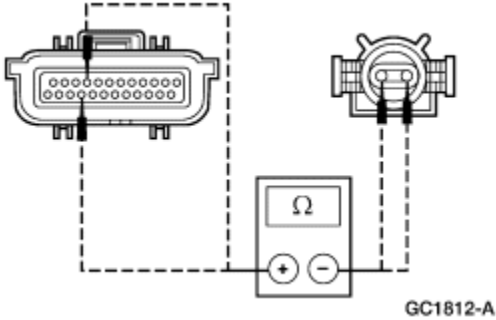
GC1811-A

2 Measure the resistance between 4WABS control module C1040-9, circuit 523 (R/PK), and ground; and between 4WABS control module C1040-21, circuit 519 (LG/BK), and ground.

- Are the resistances greater than 10,000

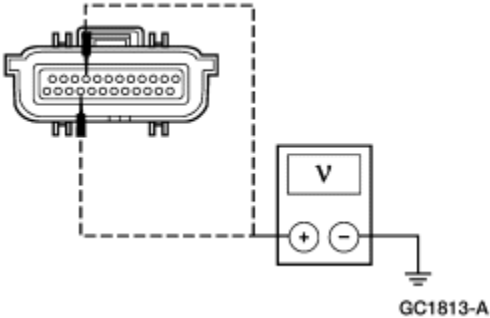
	<p>ohms?</p> <p>→ Yes GO to B19.</p> <p>→ No REPAIR circuit 523 (R/PK) or 519 (LG/BK). CLEAR the DTCs. TEST the system for normal operation.</p>
--	---

B19 CHECK CIRCUITS 523 (R/PK) AND 519 (LG/BK) FOR OPEN




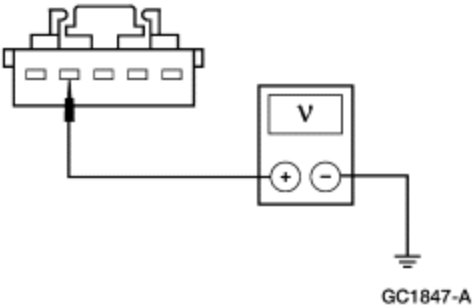
<p>1</p>  <p>GC1812-A</p>	<p>1 Measure the resistance between rear anti-lock brake sensor C404, circuit 523 (R/PK) and 4WABS control module C1040-9, circuit 523 (R/PK); and between rear anti-lock brake sensor C404, circuit 519 (LG/BK), and 4WABS control module C1040-21, circuit 519 (LG/BK).</p>
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	<ul style="list-style-type: none"> • Are the resistances less than 5 ohms? <p>→ Yes GO to B20.</p> <p>→ No REPAIR circuit 523 (R/PK) or 519 (LG/BK). TEST the system for normal operation.</p>
--	--






B20 CHECK CIRCUITS 523 (R/PK) AND 519 (LG/BK) FOR SHORT TO POWER


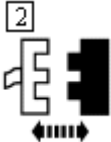

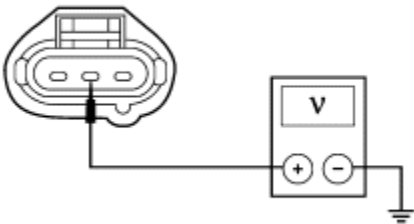
<p>1</p>  <p>GC1813-A</p>	<p>1 Measure the voltage between 4WABS control module C1040-9, circuit 523 (R/PK), and ground; and between 4WABS control module C1040-21, circuit 519 (LG/BK), and ground.</p>
---	---

	<ul style="list-style-type: none"> • Is any voltage indicated?
--	--

	<p>→ Yes REPAIR circuit 523 (R/PK) or 519 (LG/BK). TEST the system for normal operation.</p> <p>→ No DIAGNOSE the 4WABS system; REFER to Section 206-09B.</p>
B21 CHECK CIRCUIT 810 (R/LG) FOR SHORT TO POWER	
<p>1</p> 	
<p>2</p>  <p>BPP Switch C279</p>	
<p>3</p> 	
<p>4</p> 	<p>4 Measure the voltage between BPP switch C279-2, circuit 810 (R/LG), and ground.</p>
	<ul style="list-style-type: none"> • Is any voltage indicated? <p>→ Yes REPAIR circuit 810 (R/LG). CLEAR the DTCs. TEST the system for normal operation.</p> <p>→ No REPLACE the BPP switch; REFER to Section 417-01. CLEAR the DTCs. TEST the system for normal operation.</p>

***PINPOINT TEST C: THE FRONT AXLE IS NOT ENGAGING PROPERLY
(TRANSFER CASE MOTOR MOVEMENT OK)***

CONDITIONS	DETAILS/RESULTS/ACTIONS
C1 RETRIEVE THE DIAGNOSTIC TROUBLE CODES (DTCs)	
<div>1</div> 	
<div>2</div>  <p>NGS</p>	
<div>3</div> 	<div>3</div> Retrieve and document continuous DTCs.
<div>4</div>  <p>Clear Continuous DTCs</p>	
<div>5</div>  <p>GEM On-Demand Self-Test</p>	
	<ul style="list-style-type: none"> Are any DTCs retrieved? <p>→ Yes</p> <p>If DTC P1832, GO to C3 .</p> <p>If DTC P1834, GO to C5 .</p> <p>If DTC P1876, GO to C3 .</p> <p>If DTC P1877, GO to C5 .</p> <p>If DTC P1832 and DTC P1876 are retrieved together,</p>

	<p>GO to C2 .</p> <p>→ No GO to C7.</p>
C2 CHECK FOR VOLTAGE TO THE PVH SOLENOID — CIRCUIT 295 (LB/BK)	
<p>1</p> 	
<p>2</p>  <p>PVH Solenoid C115</p>	
<p>3</p> 	
<p>4</p>  <p>GC1692-A</p>	<p>4 Measure the voltage between PVH solenoid C115-2, circuit 295 (LB/BK), and ground.</p>
	<ul style="list-style-type: none"> Is the voltage greater than 10 volts? <p>→ Yes REPLACE the PVH solenoid; REFER to Section 204-01B. CLEAR the DTCs. TEST the system for normal operation.</p> <p>→ No REPAIR circuit 295 (LB/BK). TEST the system for normal operation.</p>
C3 CHECK CIRCUITS 605 (R) AND 145 (GY/BK) FOR SHORT TO GROUND	
<p>1</p>	

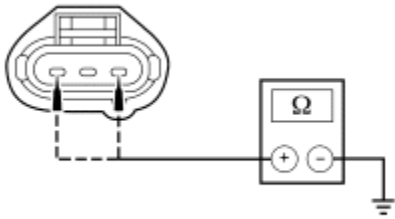


PVH Solenoid C115



GEM C247

4



GC1745-A

4 Measure the resistance between PVH solenoid C115-1, circuit 605 (R), and ground; and between PVH solenoid C115-3, circuit 145 (GY/BK), and ground.

- Are the resistances greater than 10,000 ohms?

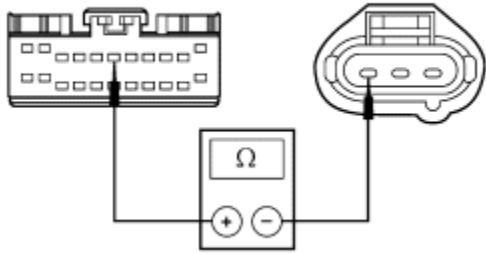
→ Yes
GO to [C4](#).

→ No
REPAIR circuit 605 (R) or 145 (GY/BK). CLEAR the DTCs. TEST the system for normal operation.

C4 CHECK CIRCUITS 605 (R) AND 145 (GY/BK) FOR OPEN

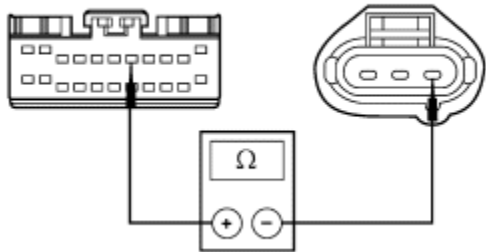
1

1 Measure the resistance between GEM C247-6, circuit 605 (R), and PVH solenoid C115-1, circuit 605 (R).



GC1858-A

2



GC1697-A

2 Measure the resistance between GEM C247-7, circuit 145 (GY/BK), and PVH solenoid C115-3, circuit 145 (GY/BK).

- Are the resistances less than 5 ohms?

→ Yes
GO to [C6](#).

→ No
REPAIR circuit 605 (R) or 145 (GY/BK). CLEAR the DTCs. TEST the system for normal operation.

C5 CHECK CIRCUITS 605 (R) AND 145 (GY/BK) FOR SHORTS TO POWER

1



2




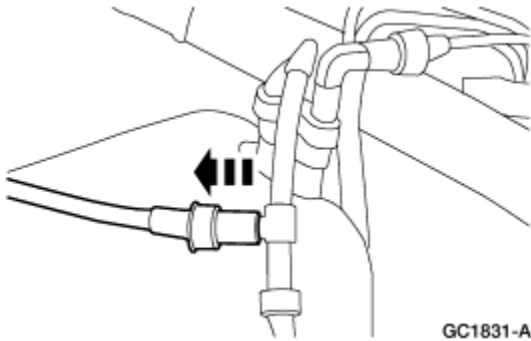
PVH Solenoid C115

3



GEM C247	
<div data-bbox="168 243 201 275" data-label="Text">4</div> <div data-bbox="168 275 279 384" data-label="Image"> </div>	
<div data-bbox="168 405 201 436" data-label="Text">5</div> <div data-bbox="246 495 639 709" data-label="Image"> </div> <div data-bbox="602 753 688 774" data-label="Text">GC1746-A</div>	<div data-bbox="719 405 751 436" data-label="Text">5</div> <p>Measure the voltage between PVH solenoid C115-1, circuit 605 (R), and ground; and between PVH solenoid C115-3, circuit 145 (GY/BK), and ground.</p>
	<ul style="list-style-type: none"> Is the voltage greater than 10 volts? <p>→ Yes REPAIR circuit 605 (R) or 145 (GY/BK). CLEAR the DTCs. TEST the system for normal operation.</p> <p>→ No REPLACE the GEM; REFER to Section 419-10. CLEAR the DTCs. TEST the system for normal operation.</p>
C6 CHECK THE PVH SOLENOID COILS	
<div data-bbox="168 1314 201 1346" data-label="Text">1</div> <div data-bbox="318 1367 506 1665" data-label="Image"> </div> <div data-bbox="605 1665 696 1686" data-label="Text">GC1698-A</div>	<div data-bbox="719 1314 751 1346" data-label="Text">1</div> <p>Measure the resistance between the PVH solenoid terminal 1 and terminal 3.</p>
	<ul style="list-style-type: none"> Is the resistance between 90 and 115 ohms? <p>→ Yes</p>

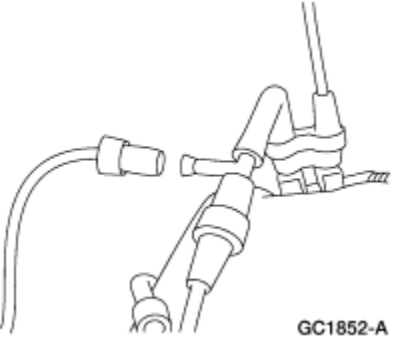
	<p>REPLACE the GEM; REFER to Section 419-10. CLEAR the DTCs. TEST the system for normal operation.</p> <p>→ No REPLACE the PVH solenoid; REFER to Section 204-01B. TEST the system for normal operation.</p>
C7 CHECK THE HUB LOCKS MANUALLY	
	<p>1 Raise and support the vehicle; refer to Section 100-02.</p>
	<p>2 Cycle both manual hub lock switches from LOCK to AUTO/FREE.</p>
	<p>3 Observe the front driveshaft while spinning both front wheels.</p>
	<p>4 Cycle both manual hub lock switches from AUTO/FREE to LOCK.</p>
	<p>5 Observe the front driveshaft while spinning both front wheels.</p>
	<ul style="list-style-type: none"> Does the driveshaft rotate when the manual hub lock switches are in LOCK and remain stationary when the manual hub lock switches are in AUTO/FREE? <p>→ Yes GO to C8.</p> <p>→ No REPLACE the hublock. REFER to Section 204-01B. TEST the system for normal operation.</p>
C8 CHECK THE PVH SYSTEM FOR LEAKS — A/C SYSTEM DISCONNECTED	
<p>1</p> 	
<p>2</p>	<p>2 Disconnect the A/C vacuum input line.</p>



GC1831-A

3

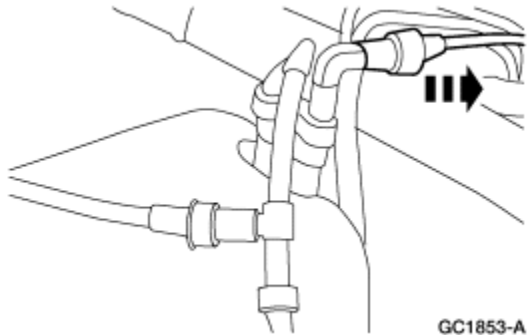
3 Plug the A/C vacuum line tee fitting.



GC1852-A

4

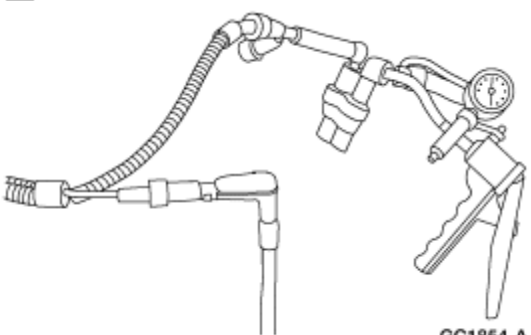
4 Disconnect the vacuum reservoir input connector.



GC1853-A

5


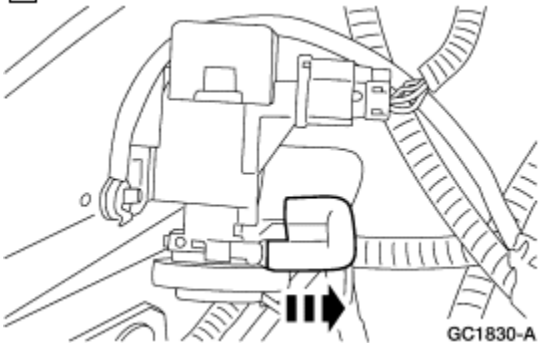
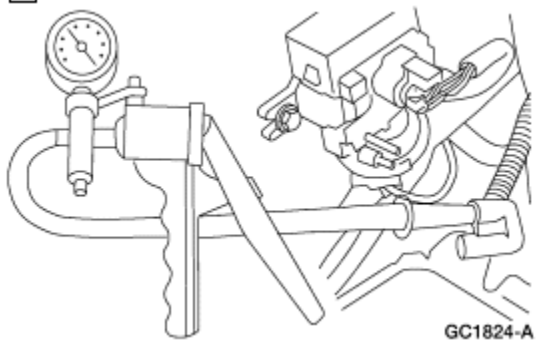
5 Connect a hand vacuum pump to the vacuum reservoir input connector and try to pull a vacuum to 15 in/Hg.

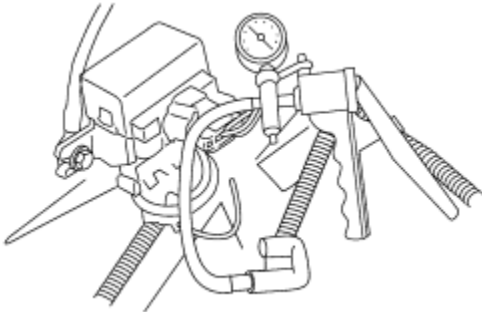
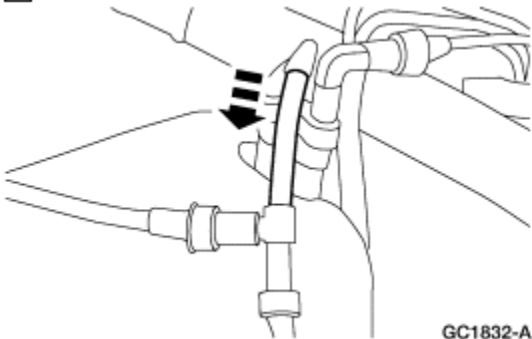
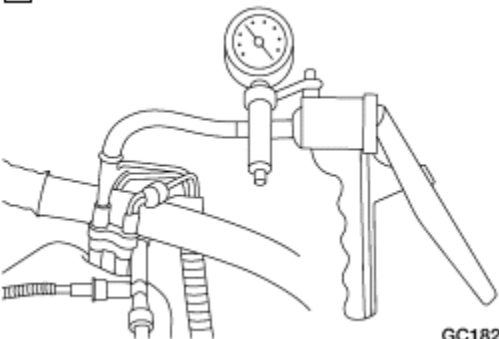


GC1854-A

- Does the vacuum drop exceed 0.5 in/Hg in 60 seconds?

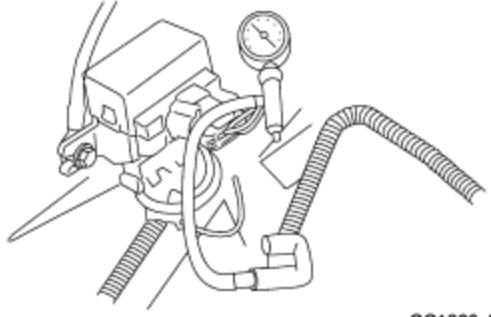

→ Yes

	<p>RECONNECT the A/C vacuum input line and vacuum reservoir input line. GO to C9 .</p> <p>→ No DIAGNOSE the A/C system. REFER to Section 412-00. TEST the system for normal operation.</p>
C9 LEAK TEST THE WHEEL ENDS AND LOWER VACUUM SYSTEM — SOLENOID OUTPUT	
<p>1</p> 	
<p>2</p> 	<p>2 Disconnect the PVH solenoid vacuum connector.</p>
<p>3</p> 	<p>3 NOTE: This step may require rapid pumping for up to 20 seconds.</p> <p>Connect a hand vacuum pump to the PVH solenoid upper port hose connector and try to pull a vacuum to 15 in/Hg.</p>
	<ul style="list-style-type: none"> • Does the vacuum drop exceed 0.5 in/Hg in 60 seconds? <p>→ Yes GO to C15.</p> <p>→ No GO to C10.</p>
C10 LEAK TEST THE UPPER VACUUM SYSTEM — SOLENOID INPUT	
<p>1</p>	<p>1 Connect a hand vacuum pump to the PVH</p>

 <p>GC1825-A</p>	<p>solenoid lower port hose connector and try to pull a vacuum to 15 in/Hg.</p>
	<ul style="list-style-type: none"> • Does the vacuum drop exceed 0.5 in/Hg in 60 seconds? <p>→ Yes GO to C11.</p> <p>→ No GO to C12.</p>
<p>C11 CHECK THE VACUUM SYSTEM RESERVOIR AND VACUUM LINES</p>	
<p>1</p>  <p>GC1832-A</p>	<p>1 Disconnect the vacuum reservoir output tee connector.</p>
<p>2</p>  <p>GC1823-A</p>	<p>2 Connect a hand vacuum pump to the vacuum reservoir output line connector and try to pull a vacuum to 15 in/Hg.</p>
	<ul style="list-style-type: none"> • Does the vacuum drop exceed 0.5 in/Hg in 60 seconds?


	<p>→ Yes DIAGNOSE the engine vacuum system; REFER to Section 303-00.</p> <p>→ No REPAIR or REPLACE the vacuum reservoir output tee fitting or vacuum line between vacuum reservoir tee fitting and PVH vacuum solenoid. TEST the system for normal operation.</p>
--	---

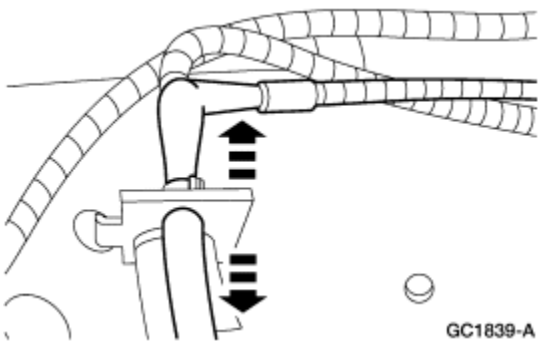


C12 CHECK THE PVH VACUUM SYSTEM FOR ENGINE VACUUM

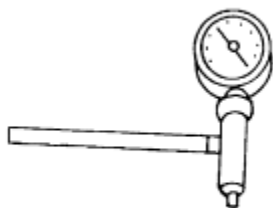
<p>1</p>  <p>GC1826-A</p>	<p>1 Connect a vacuum gauge to the PVH solenoid lower port hose connector and measure the vacuum level.</p>
<p>2</p> 	
	<ul style="list-style-type: none"> • Is the vacuum level greater than 11 in/Hg? <p>→ Yes RECONNECT the PVH solenoid vacuum connector. GO to C13.</p> <p>→ No GO to C14.</p>

C13 CHECK THE PVH SOLENOID FOR PROPER VACUUM OUTPUT LEVELS — 4X4 DISENGAGED

NOTE: This step requires the use of a calibrated vacuum gauge that is accurate to within a minimum of 0.1 in/Hg. It is recommended that Pressure/Vacuum Module 105-R0099 or equivalent be used for this check.

<p>1</p> 	
<p>2</p>	<p>2 Disconnect the RH wheel end vacuum line</p>

 <p>GC1839-A</p>	<p>connector from the crossmember vacuum line connector.</p>
<p>3</p> 	
	<p>4 Connect a calibrated vacuum gauge to the crossmember vacuum line connector and measure the vacuum while switching the 4X4 mode switch from 4X4 HIGH to 2WD.</p>
	<ul style="list-style-type: none"> Does the vacuum gauge indicate between 5.85 and 7.1 in/Hg after six seconds but not longer than 60 seconds after switching the 4X4 mode switch to 2WD? <p>→ Yes REMOVE the vacuum gauge. RECONNECT all vacuum lines. TEST the system for normal operation. If the 4X4 system still does not operate properly, CLARIFY the customer concern and RETURN to Symptom Chart.</p> <p>→ No REPLACE the PVH solenoid; REFER to Section 204-01B. TEST the system for normal operation.</p>
<p>C14 CHECK THE VACUUM RESERVOIR INPUT VACUUM LINE FOR VACUUM</p>	
<p>1</p> 	
	<p>2 Disconnect the engine vacuum output connector (gas) or the vacuum pump output connector (diesel).</p>
<p>3</p>	<p>3 Connect a vacuum gauge to the engine vacuum output connector (gas) or the vacuum pump output connector (diesel) and measure the vacuum level.</p>



GC1722-A

- **Is the vacuum level greater than 11 in/Hg?**

→ **Yes**

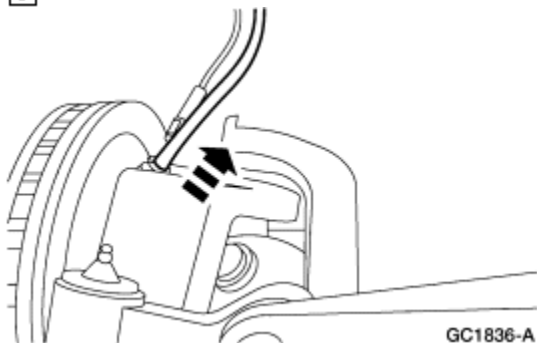
REPAIR or REPLACE the vacuum reservoir or vacuum lines between the PVH solenoid vacuum input line and vacuum reservoir input line. TEST the system for normal operation.

→ **No**

DIAGNOSE the engine vacuum system; REFER to [Section 303-00](#).

C15 CHECK THE RH SIDE WHEEL END FOR LEAKS

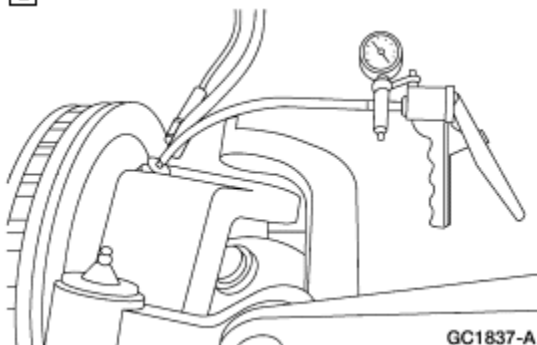
1



GC1836-A

- 1** Disconnect the RH wheel end vacuum line from the wheel end.

2



GC1837-A

- 2** **NOTE:** This step may require rapid pumping for up to 10 seconds.

Connect a hand vacuum pump to the RH wheel end vacuum line fitting and try to pull a vacuum to 15 in/Hg.

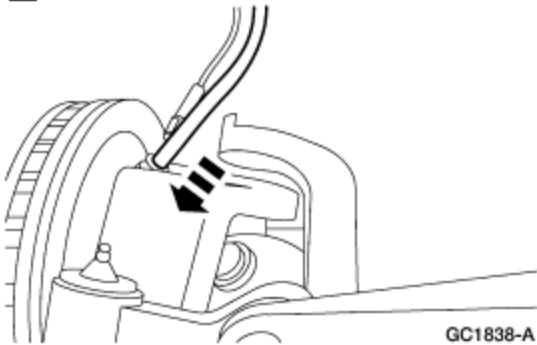
- Does the vacuum drop exceed 0.5 in/Hg in 60 seconds?

→ Yes
GO to [C19](#).

→ No
GO to [C16](#).

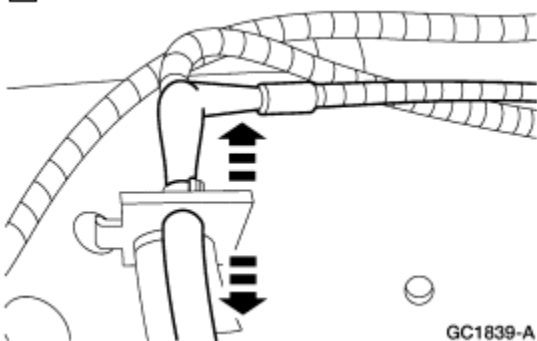
C16 CHECK THE RH WHEEL END VACUUM LINE FOR VACUUM LEAKS

1



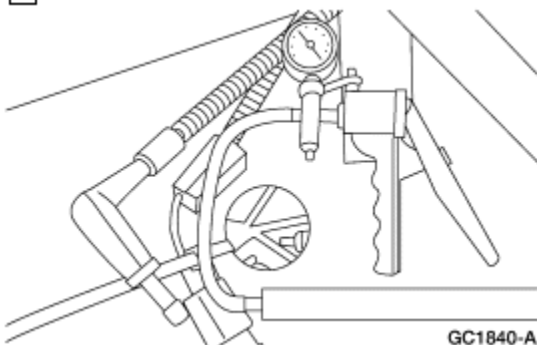
1 Reconnect the RH wheel end vacuum line to the wheel end.

2



2 Disconnect the RH wheel end vacuum line from the crossmember vacuum line connector.

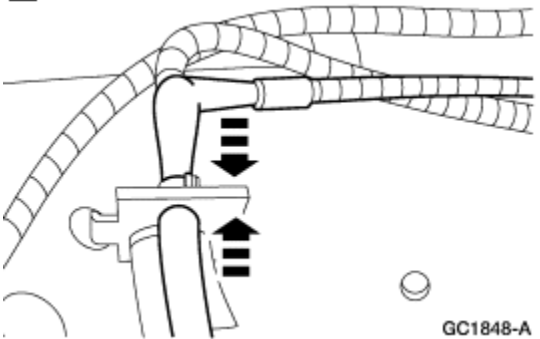
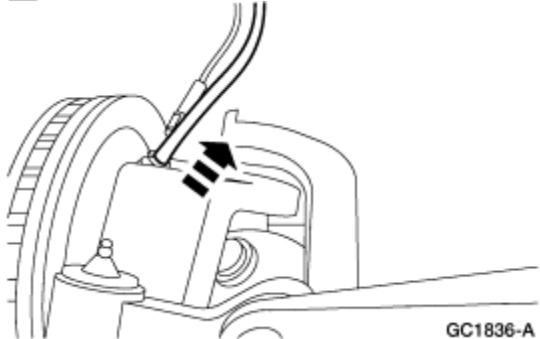
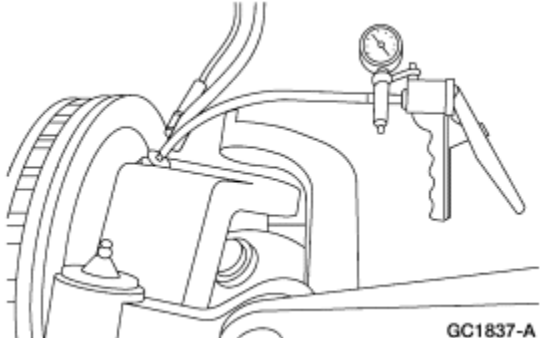
3



3 **NOTE:** This step may require rapid pumping for up to 10 seconds.

Connect a hand vacuum pump to the RH wheel end vacuum line and try to pull a vacuum to 15 in/Hg.

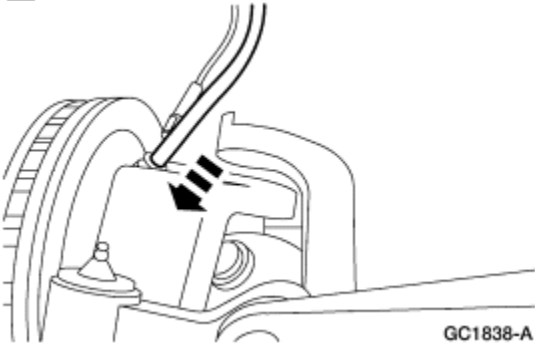
- Does the vacuum drop exceed 0.5 in/Hg in 60 seconds?

	<p>→ Yes REPAIR or REPLACE the RH wheel end vacuum line. TEST the system for normal operation.</p> <p>→ No GO to C17.</p>
C17 CHECK THE LH SIDE WHEEL END FOR LEAKS	
<p>1</p>  <p>GC1848-A</p>	<p>1 Reconnect the RH wheel end vacuum line to the crossmember vacuum line connector.</p>
<p>2</p>  <p>GC1836-A</p>	<p>2 Disconnect the LH wheel end vacuum line from the wheel end.</p>
<p>3</p>  <p>GC1837-A</p>	<p>3 NOTE: This step may require rapid pumping for up to 10 seconds. Connect a hand vacuum pump to the LH wheel end vacuum line fitting and try to pull a vacuum to 15 in/Hg.</p>
	<ul style="list-style-type: none"> • Does the vacuum drop exceed 0.5 in/Hg in 60 seconds? <p>→ Yes GO to C19.</p>

→ **No**
GO to [C18](#).

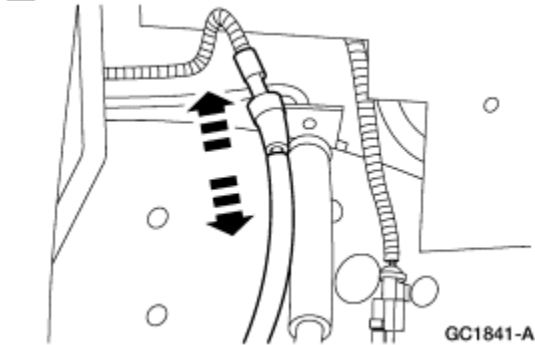
C18 CHECK THE LH WHEEL END VACUUM LINE FOR LEAKS

1



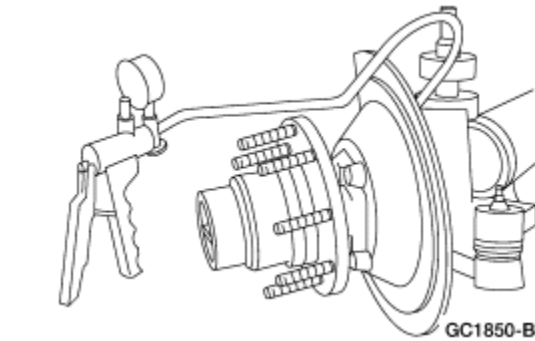
1 Reconnect the LH wheel end vacuum line to the wheel end.

2



2 Disconnect the LH wheel end vacuum line from the crossmember vacuum harness.

3



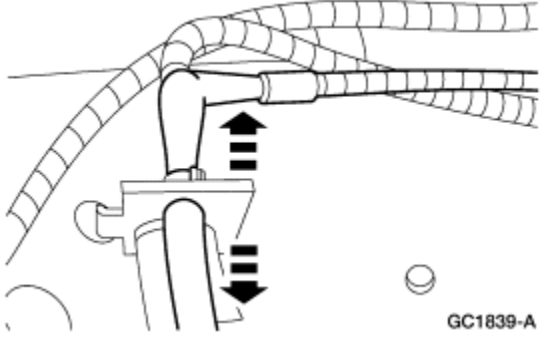
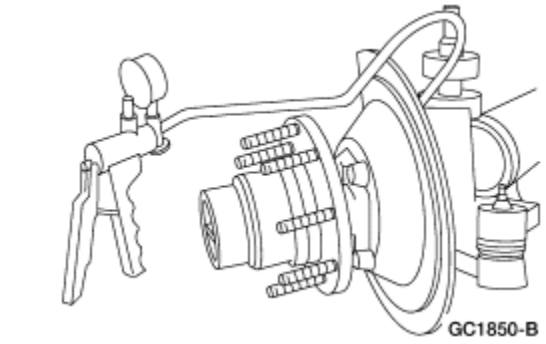
3 **NOTE:** This step may require rapid pumping for up to 10 seconds.
Connect a hand vacuum pump to the LH wheel end vacuum supply hose and try to pull a vacuum to 15 in/Hg.

- **Does the vacuum drop exceed 0.5 in/Hg in 60 seconds?**

→ **Yes**
REPAIR or REPLACE the LH wheel end vacuum line. TEST the system for normal operation.

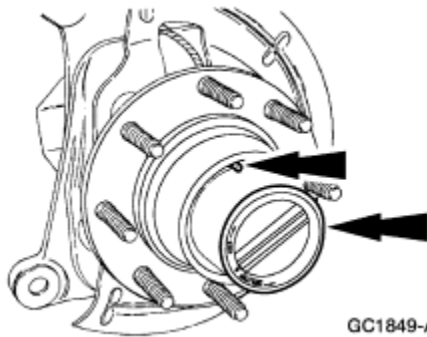
→ **No**
REPAIR or REPLACE the crossmember vacuum harness. TEST the system for normal operation.

C19 CHECK THE WHEEL END FOR TYPE OF VACUUM LEAK — STATIC OR DYNAMIC

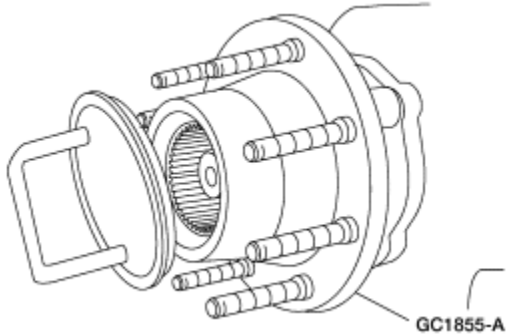
<div data-bbox="164 235 706 619"><div>1</div><div>GC1839-A</div></div>	<div data-bbox="706 235 1411 619"><div>1</div> Disconnect the wheel end vacuum line connector from the crossmember vacuum line.</div>
<div data-bbox="164 619 706 1008"><div>2</div><div>GC1850-B</div></div>	<div data-bbox="706 619 1411 1008"><div>2</div> NOTE: This step may require rapid pumping for up to 20 seconds. Connect a hand vacuum pump to the wheel end vacuum line and try to pull a vacuum to 15 in/Hg.</div>
	<div data-bbox="706 1008 1411 1102"><div>3</div> Observe the vacuum gauge for at least 60 seconds while the wheel is stationary.</div>
	<div data-bbox="706 1102 1411 1192"><div>4</div> Observe the vacuum gauge for at least 60 seconds while rotating the wheel.</div>
	<div data-bbox="706 1192 1411 1575"><ul style="list-style-type: none">Does the vacuum drop exceed 0.5 in/Hg in 60 seconds when the wheel is stationary?<div>→ Yes GO to C20.</div><div>→ No GO to C21.</div></div>

C20 CHECK THE HUBLOCK FOR VACUUM LEAKS

<div data-bbox="164 1627 706 1675"><div>1</div></div>	<div data-bbox="706 1627 1411 1675"><div>1</div> Remove the retainer ring and hublock assembly.</div>
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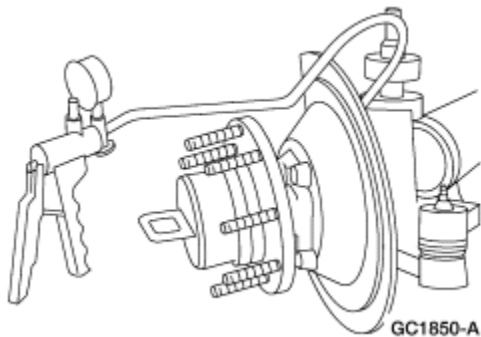


2



2 Connect a suitable vacuum cap (P/N 11A02) to the wheel end.

3



3 Connect a hand vacuum pump to the wheel end vacuum supply hose and try to pull a vacuum to 10-12 in/Hg.

- Does the vacuum drop exceed 0.5 in/Hg in 60 seconds?

→ Yes


REPLACE the wheel hub O-ring. TEST the system for normal operation. If the leak persists, REPLACE the RDS knuckle seal. TEST the system for normal operation. If the leak persists, REPLACE the wheel hub. REFER to [Section 204-01B](#). TEST the system for normal operation.






→ No



REINSTALL the hublock using a new hublock O-ring. TEST the system for normal operation. If the




	leak persists, REPLACE the hublock. TEST the system for normal operation.
C21 ISOLATE THE DYNAMIC VACUUM LEAK — RDS KNUCKLE SEAL OR WHEEL HUB SEAL	
	1 Verify the vehicle is in 2WD rotating the front wheel and ensuring the driveshaft does not spin.
	2 Connect a hand vacuum pump to the wheel end vacuum line and try to pull a vacuum to 15 in/Hg.
	3 Observe the vacuum gauge for at least 60 seconds while rotating the wheel.
	4 Cycle the manual hublock switch from AUTO/FREE to LOCK.
	5 Connect a hand vacuum pump to the wheel end vacuum line and try to pull a vacuum to 15 in/Hg.
	6 Observe the vacuum gauge for at least 60 seconds while rotating the wheel.
	<ul style="list-style-type: none"> Does the vacuum drop exceed 0.5 in/Hg in 60 seconds only when the manual hublock switch is in the LOCK position? <p>→ Yes REPLACE the RDS knuckle seal. REFER to Section 204-01B. TEST the system for normal operation.</p> <p>→ No REPLACE the wheel hub; REFER to Section 204-01B. TEST the system for normal operation.</p>

PINPOINT TEST D: THE 4X4 HIGH or 4X4 LOW RANGE INDICATOR DO/DOES NOT OPERATE PROPERLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
D1 CHECK THE IGNITION STATES — MONITOR THE GEM PID IGN_GEM	
1 	
2	

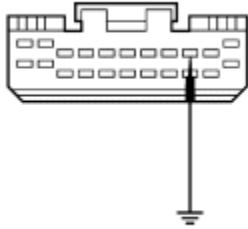
 <p>NGS</p>	
	<p>3 NOTE: If the vehicle is equipped with a manual transmission, depress the clutch pedal while turning the ignition switch to START.</p> <p>Monitor the GEM PID IGN_GEM and rotate the ignition switch through the START, RUN, OFF, and ACC positions.</p>
	<ul style="list-style-type: none"> • Do the PID values agree with the ignition switch positions? <p>→ Yes GO to D2.</p> <p>→ No REFER to Section 417-02.</p>
D2 RETRIEVE THE DIAGNOSTIC TROUBLE CODES (DTCs)	
	<p>1 Retrieve and document continuous DTCs.</p>
 <p>Clear Continuous DTCs</p>	
 <p>GEM On-Demand Self-Test</p>	
	<ul style="list-style-type: none"> • Are any DTCs recorded? <p>→ Yes If DTC B1342, REPLACE the GEM; REFER to</p>

	<p>Section 419-10. CLEAR the DTCs. TEST the system for normal operation.</p> <p>If DTC P1804, GO to D4 .</p> <p>If DTC P1806, GO to D4 .</p> <p>If DTC P1808, GO to D5 .</p> <p>If DTC P1810, GO to D5 .</p> <p>→ No GO to D3.</p>
D3 VERIFY THE INOPERATIVE INDICATOR LAMP	
<p>1</p> 	
	<p>2 Place the 4WD mode switch in 4X4 HIGH.</p>
	<p>3 Verify the 4X4 HIGH indicator illuminates.</p>
	<p>4 Depress the brake pedal, depress the clutch (M/T) or place the shift lever into NEUTRAL (A/T) and place the 4WD mode switch in 4X4 LOW.</p>
	<p>5 Verify the 4X4 LOW indicator illuminates.</p>
	<ul style="list-style-type: none"> • Is only the 4X4 HIGH indicator inoperative? <p>→ Yes GO to D4.</p> <p>→ No If only the 4X4 LOW indicator is inoperative, GO to D5 .</p> <p>If both the 4X4 HIGH and 4X4 LOW indicators are inoperative, REFER to Section 413-01.</p>
D4 CHECK THE 4x4 HIGH INDICATOR	
<p>1</p> 	<p>1 Trigger the GEM active command HIGH LAMP ON then OFF.</p>

	<ul style="list-style-type: none"> • Does the 4X4 HIGH indicator illuminate then go off? <p>→ Yes GO to D5.</p> <p>→ No If the 4X4 HIGH indicator remains on, GO to D13 .</p> <p>If the 4X4 HIGH indicator does not illuminate, GO to D9 .</p>
D5 CHECK THE 4x4 LOW INDICATOR	
<p>1</p> 	<p>1 Trigger the GEM active command LOWLAMP ON then OFF.</p>
	<ul style="list-style-type: none"> • Does the 4X4 LOW indicator illuminate then go off? <p>→ Yes Indicators are OK. GO to Pinpoint Test A.</p> <p>→ No If the 4X4 LOW indicator remains on, GO to D12 .</p> <p>If the 4X4 LOW indicator does not illuminate, GO to D6 .</p>
D6 CHECK THE GEM OUTPUT TO THE INSTRUMENT CLUSTER	
<p>1</p> 	
<p>2</p>  <p>GEM C247</p>	
<p>3</p>	



4



GC1814-A

4 Connect a fused (3A) jumper wire between GEM C247-9, circuit 210 (LB), and ground.

- Does the 4X4 HIGH indicator illuminate?

→ Yes

REPLACE the GEM; REFER to [Section 419-10](#).
TEST the system for normal operation.

→ No

If the fuse opens or the indicator does not illuminate,
GO to [D7](#).

D7 CHECK CIRCUIT 975 (BR/Y) FOR SHORT TO POWER

1



2



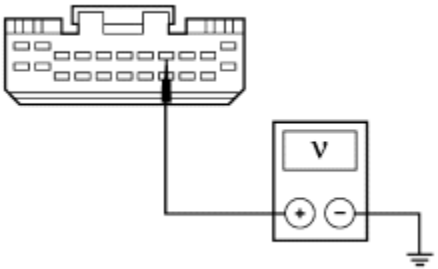

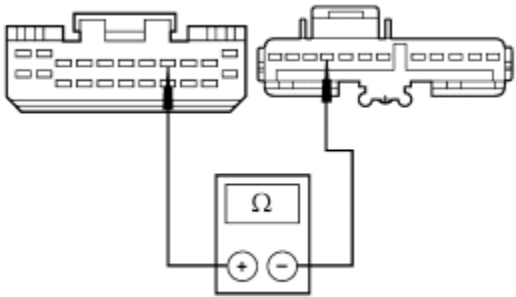
Instrument Cluster C253




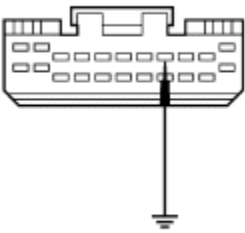

3



4

4 Measure the voltage between GEM C247-8, circuit 975 (BR/Y), and ground.

 <p>GC1815-A</p>	
	<ul style="list-style-type: none"> • Is the voltage greater than 10 volts? <p>→ Yes REPAIR circuit 975 (BR/Y). TEST the system for normal operation.</p> <p>→ No GO to D8.</p>
D8 CHECK CIRCUIT 975 (BR/Y) FOR OPEN	
<p>1</p> 	
<p>2</p>  <p>GC1816-A</p>	<p>2 Measure the resistance between GEM C247-8, circuit 975 (BR/Y), and instrument cluster C253-9, circuit 975 (BR/Y).</p>
	<ul style="list-style-type: none"> • Is the resistance less than 5 ohms? <p>→ Yes CHECK the indicator bulbs. If OK, REPLACE the instrument cluster. TEST the system for normal operation.</p> <p>→ No REPAIR circuit 975 (BR/Y). TEST the system for</p>

	normal operation.
D9 CHECK THE INSTRUMENT CLUSTER	
<div>1</div> 	
<div>2</div>  <p>GEM C247</p>	
<div>3</div> 	
<div>4</div>  <p>GC1817-A</p>	<div>4</div> Connect a fused (3A) jumper wire between GEM C247-8, circuit 975 (BR/Y), and ground.
	<ul style="list-style-type: none"> Does the 4X4 LOW indicator illuminate? <p>→ Yes REPLACE the GEM; REFER to Section 419-10. TEST the system for normal operation.</p> <p>→ No If the fuse opens or the indicator does not illuminate, GO to D10 .</p>
D10 CHECK CIRCUIT 210 (LB) FOR SHORT TO POWER	
<div>1</div> 	
<div>2</div>	

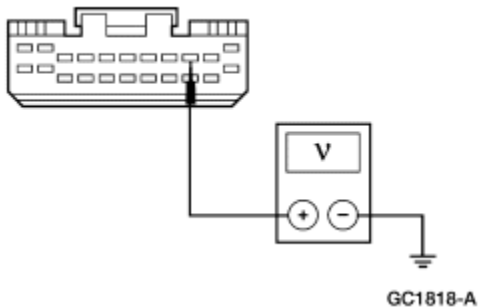


Instrument Cluster C253

3



4



4 Measure the voltage between GEM C247-9, circuit 210 (LB), and ground.

- **Is any voltage indicated?**

→ **Yes**
REPAIR circuit 210 (LB). TEST the system for normal operation.

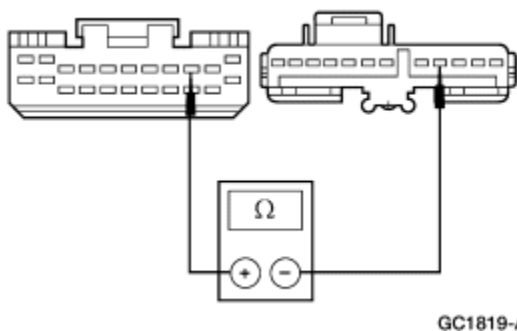
→ **No**
GO to [D11](#).

D11 CHECK CIRCUIT 210 (LB) FOR OPEN



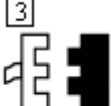
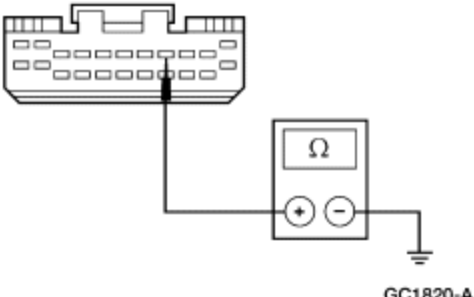
1




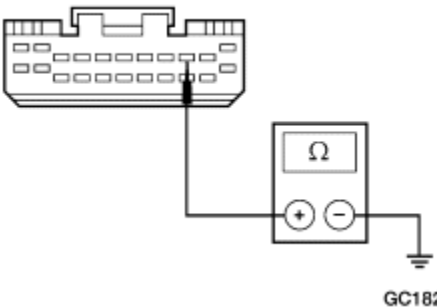


2



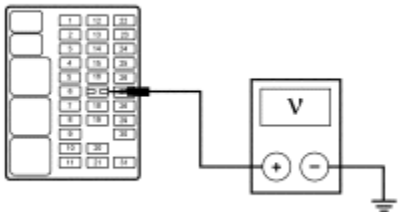


2 Measure the resistance between GEM C247-9, circuit 210 (LB), and instrument cluster C253-4, circuit 210 (LB).

	<ul style="list-style-type: none"> • Is the resistance less than 5 ohms? <p>→ Yes CHECK the indicator bulbs. If OK, REPLACE the instrument cluster. TEST the system for normal operation.</p> <p>→ No REPAIR circuit 210 (LB). TEST the system for normal operation.</p>
D12 CHECK CIRCUIT 975 (BR/Y) FOR SHORT TO GROUND	
<p>1</p> 	
<p>2</p>  <p>GEM C247</p>	
<p>3</p>  <p>Instrument Cluster C253</p>	
<p>4</p> 	<p>4 Measure the resistance between GEM C247-9, circuit 975 (BR/Y), and ground.</p>
	<ul style="list-style-type: none"> • Is the resistance greater than 10,000 ohms? <p>→ Yes REPLACE the GEM. REFER to Section 419-10.</p>

	<p>TEST the system for normal operation.</p> <p>→ No REPAIR circuit 975 (BR/Y). TEST the system for normal operation.</p>
D13 CHECK CIRCUIT 210 (LB) FOR SHORT TO GROUND	
<p>1</p> 	
<p>2</p>  <p>GEM C247</p>	
<p>3</p>  <p>Instrument Cluster C253</p>	
<p>4</p> 	<p>4 Measure the resistance between GEM C247-9, circuit 210 (LB), and ground.</p>
	<ul style="list-style-type: none"> Is the resistance greater than 10,000 ohms? <p>→ Yes REPLACE the GEM. REFER to Section 419-10. TEST the system for normal operation.</p> <p>→ No REPAIR circuit 210 (LB). TEST the system for normal operation.</p>

PINPOINT TEST E: NO COMMUNICATION WITH THE MODULE — GENERIC ELECTRONIC MODULE

CONDITIONS	DETAILS/RESULTS/ACTIONS
E1 CHECK FUSE JUNCTION PANEL FUSE 15 (5A)	
<div>1</div> 	
<div>2</div>  <p>Fuse 15 (5A)</p>	
	<ul style="list-style-type: none"> Is the fuse OK? <p>→ Yes REINSTALL the fuse. GO to E2 .</p> <p>→ No GO to E3.</p>
E2 CHECK FOR VOLTAGE AT FUSE/JUNCTION PANEL FUSE 15 (5A)	
<div>1</div>  <p>GK7657-A</p>	<div>1</div> Measure the voltage between fuse junction panel fuse 15 (5A) and ground.
	<ul style="list-style-type: none"> Is the voltage greater than 10 volts? <p>→ Yes GO to E4.</p> <p>→ No GO to E5.</p>

E3 CHECK FUSE JUNCTION PANEL FOR SHORT TO GROUND

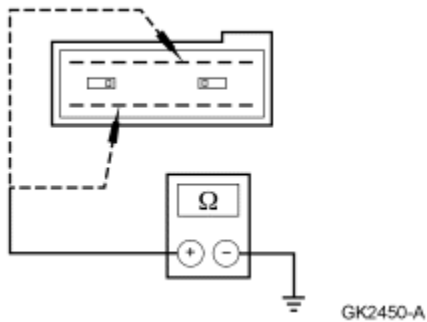


Fuse 15 (5A)



GEM C241

3



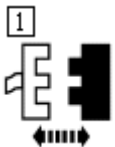
3 Measure the resistance between fuse junction panel C241, terminal 4, and ground; and between fuse junction panel C241, terminal 16, and ground.

- Are the resistances greater than 10,000 ohms?

→ Yes
GO to [E16](#).

→ No
REPLACE the fuse junction panel. TEST the system for normal operation.

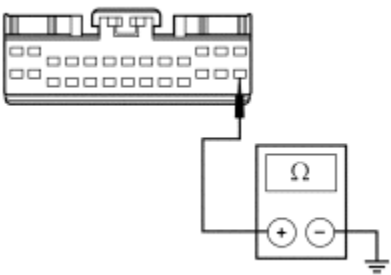
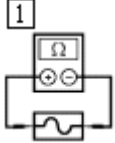
E4 CHECK CIRCUIT 676 (PK/O) FOR OPEN


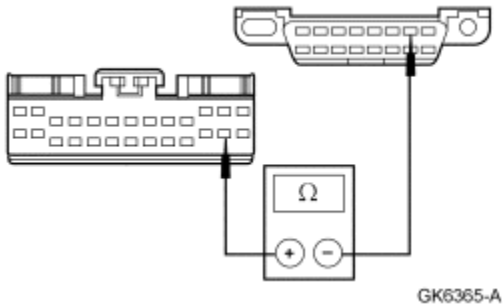


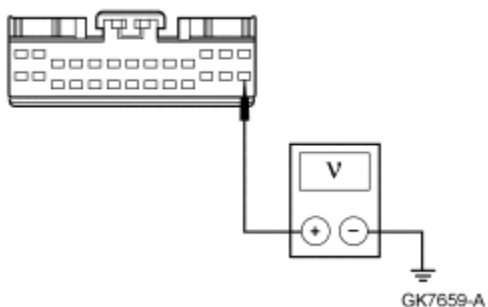
GEM C239

2

2 Measure the resistance between GEM C239-26, circuit 676 (PK/O), and ground.

 <p style="text-align: right;">GK6309-A</p>	
	<ul style="list-style-type: none"> • Is the resistance less than 5 ohms? <p>→ Yes GO to E7.</p> <p>→ No REPAIR circuit 676 (PK/O). TEST the system for normal operation.</p>
E5 CHECK THE POWER DISTRIBUTION BOX FUSE 22 (50A)	
<p>1</p>  <p>Fuse 22 (50A)</p>	
	<p>2 Remove and inspect the fuse.</p>
	<ul style="list-style-type: none"> • Is the fuse OK? <p>→ Yes REINSTALL the fuse. GO to E6 .</p> <p>→ No REPAIR circuit 1052 (T/BK). TEST the system for normal operation.</p>
E6 CHECK CIRCUIT 1052 (T/BK) FOR OPEN	
	<p>1 Measure the voltage between power distribution box fuse 22 (50A) and ground.</p>
	<ul style="list-style-type: none"> • Is the voltage greater than 10 volts?

	<p>→ Yes REPAIR circuit 1052 (T/BK). TEST the system for normal operation.</p> <p>→ No REPAIR/REPLACE the power distribution box. TEST the system for normal operation.</p>
E7 CHECK CIRCUIT 70 (LB/W) FOR OPEN	
<p>1</p>  <p>GEM C239</p>	
2 Verify the NGS is disconnected.	
<p>3</p>  <p>GK6365-A</p>	<p>3 Measure the resistance between GEM C239-25, circuit 70 (LB/W), and DLC C227-7, circuit 70 (LB/W).</p>
	<ul style="list-style-type: none"> Is the resistance less than 5 ohms? <p>→ Yes GO to E8.</p> <p>→ No REPAIR circuit 70 (LB/W). TEST the system for normal operation.</p>
E8 CHECK CIRCUIT 676 (PK/O) FOR SHORT TO POWER	
<p>1</p>	<p>1 Measure the voltage between GEM C239-26, circuit 676 (PK/O), and ground.</p>



- **Is the voltage greater than 10 volts?**

→ **Yes**

REPAIR circuit 676 (PK/O). REPLACE the GEM; REFER to [Section 419-10](#). TEST the system for normal operation.

→ **No**

If equipped with ESOF, GO to [E9](#) .

If not equipped with ESOF, GO to [E11](#) .

E9 CHECK CIRCUIT 465 (W/LB)

1



2



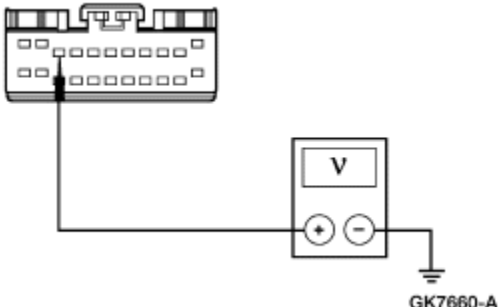
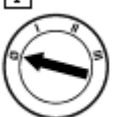


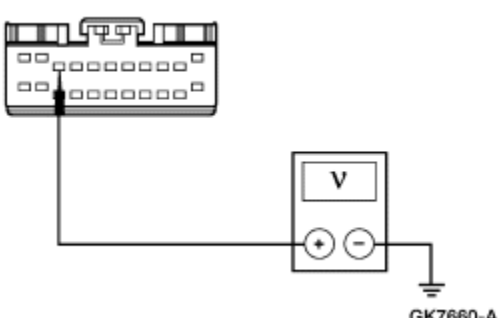
GEM C247

3



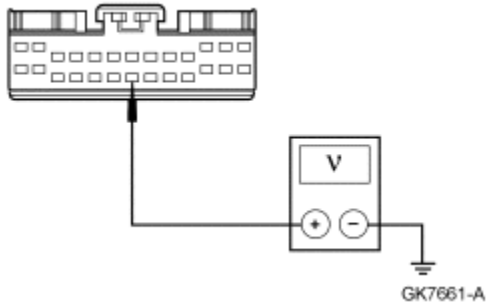
4

4 Measure the voltage between GEM C247-3, circuit 465 (W/LB), and ground.

	
	<ul style="list-style-type: none"> • Is the voltage greater than 10 volts? <p>→ Yes GO to E10.</p> <p>→ No GO to E11.</p>
E10 CHECK CIRCUIT 465 (W/LB) FOR SHORT TO POWER	
<p>1</p> 	
<p>2</p>  <p>4WD Mode Switch C246</p>	
<p>3</p> 	
<p>4</p> 	<p>4 Measure the voltage between GEM C247-3, circuit 465 (W/LB), and ground.</p>



	<ul style="list-style-type: none"> • Is the voltage greater than 10 volts? <p>→ Yes REPAIR circuit 465 (W/LB). REPLACE the GEM; REFER to Section 419-10. TEST the system for normal operation.</p> <p>→ No REPLACE the 4WD mode select switch. REPLACE the GEM; REFER to Section 419-10. TEST the system for normal operation.</p>
--	--

E11 CHECK CIRCUIT 682 (DB) FOR SHORT TO POWER

<p>1</p> 	<p>1 Measure the voltage between GEM C239-20, circuit 682 (DB), and ground.</p>
--	--

	<ul style="list-style-type: none"> • Is the voltage greater than 10 volts? <p>→ Yes GO to E12.</p> <p>→ No GO to E13.</p>
--	---

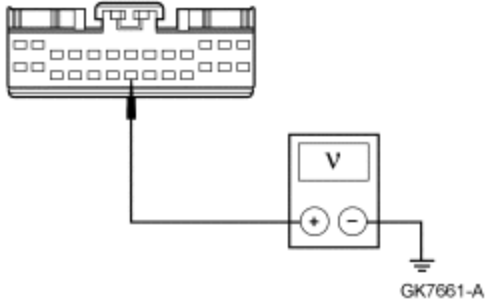
E12 CHECK CIRCUIT 682 (DB) FOR SHORT TO POWER (MULTI-FUNCTION SWITCH DISCONNECTED)

<p>1</p> 	
<p>2</p>  <p>Multi-Function Switch C230</p>	

3



4



4 Measure the voltage between GEM C239-20, circuit 682 (DB), and ground.

- Is the voltage greater than 10 volts?

→ Yes

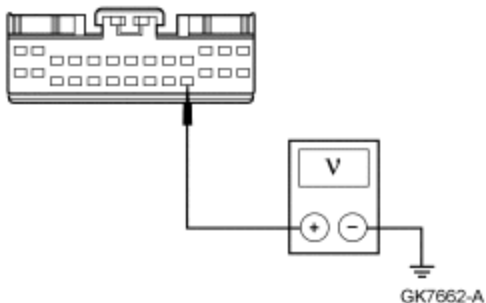
REPAIR circuit 682 (DB). REPLACE the GEM; REFER to [Section 419-10](#). TEST the system for normal operation.

→ No

REPLACE the wiper multi-function switch. REPLACE the GEM; REFER to [Section 419-10](#). TEST the system for normal operation.

E13 CHECK CIRCUIT 684 (PK/Y) FOR SHORT TO POWER

1




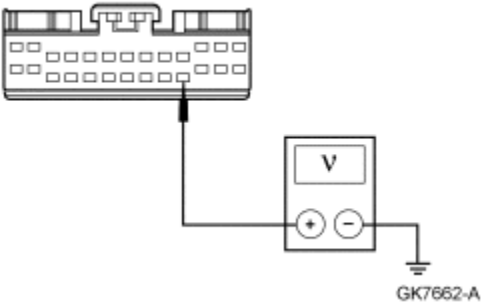





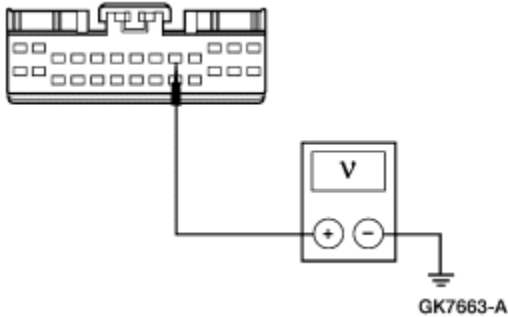

1 Measure the voltage between GEM C239-23, circuit 684 (PK/Y), and ground.

- Is the voltage greater than 10 volts?


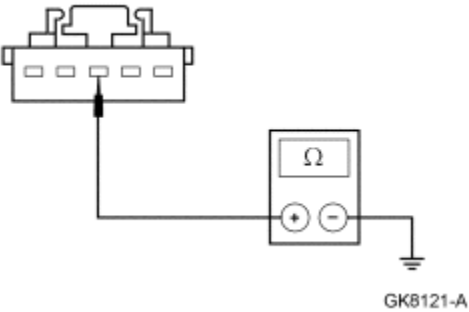
→ Yes

GO to [E14](#).

	<p>→ No If the vehicle is not equipped with anti-lock brake control module, GO to E15 .</p> <p>If the vehicle is equipped with anti-lock brake control module, REPLACE the GEM. REFER to Section 419-10. CLEAR the DTCs. TEST the system for normal operation.</p>
E14 CHECK CIRCUIT 684 (PK/Y) FOR SHORT TO POWER (MULTI-FUNCTION SWITCH DISCONNECTED)	
<p>1</p> 	
<p>2</p>  <p>Multi-Function Switch C230</p>	
<p>3</p> 	
<p>4</p> 	<p>4 Measure the voltage between GEM C239-23, circuit 684 (PK/Y), and ground.</p>
	<ul style="list-style-type: none"> Is the voltage greater than 10 volts? <p>→ Yes REPAIR circuit 684 (PK/Y). REPLACE the GEM; REFER to Section 419-10. TEST the system for normal operation.</p> <p>→ No REPLACE the multi-function switch. REPLACE the</p>

	GEM; REFER to Section 419-10 . TEST the system for normal operation.
E15 CHECK CIRCUIT 519 (LG/BK) FOR SHORT TO POWER	
<div>1</div> 	
<div>2</div>  <p>Differential Speed Sensor C404</p>	
<div>3</div> 	
<div>4</div> 	<div>4</div> Measure the voltage between GEM C239-9, circuit 519 (LG/BK), and ground.
	<ul style="list-style-type: none"> Is the voltage greater than 10 volts? <p>→ Yes REPAIR circuit 519 (LG/BK). REPLACE the GEM. TEST the system for normal operation.</p> <p>→ No REPLACE the GEM. REFER to Section 419-10. CLEAR the DTCs. TEST the system for normal operation.</p>
E16 CHECK THE HORN RELAY	
<div>1</div> 	

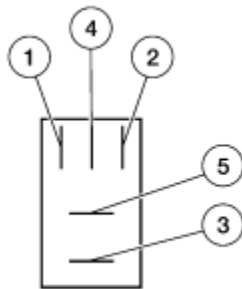
Horn Relay	
	<div data-bbox="719 237 1372 279" data-label="Text"> <p>2 Check the horn relay; refer to Component Test.</p> </div>
	<div data-bbox="760 367 1110 403" data-label="List-Group"> <ul style="list-style-type: none"> • Is the horn relay OK? </div> <div data-bbox="719 443 862 516" data-label="Text"> <p>→ Yes GO to E17.</p> </div> <div data-bbox="719 556 1323 667" data-label="Text"> <p>→ No REPLACE the horn relay. TEST the system for normal operation.</p> </div>
<div data-bbox="170 678 1015 716" data-label="Section-Header"> <p>E17 CHECK CIRCUIT 810 (R/LG) FOR SHORT TO GROUND</p> </div>	
<div data-bbox="167 730 277 877" data-label="Image"> </div> <div data-bbox="167 919 313 951" data-label="Caption"> <p>GEM C241</p> </div>	
<div data-bbox="167 968 277 1115" data-label="Image"> </div> <div data-bbox="167 1157 313 1188" data-label="Caption"> <p>GEM C247</p> </div>	
<div data-bbox="167 1205 277 1352" data-label="Image"> </div> <div data-bbox="167 1394 394 1425" data-label="Caption"> <p>BPP Switch C279</p> </div>	
<div data-bbox="167 1442 690 1818" data-label="Diagram"> </div>	<div data-bbox="719 1442 1377 1518" data-label="Text"> <p>4 Measure the resistance between GEM C247-12, circuit 810 (R/LG), and ground.</p> </div>

	<ul style="list-style-type: none"> • Is the resistance greater than 10,000 ohms? <p>→ Yes GO to E18.</p> <p>→ No REPAIR circuit 810 (R/LG). TEST the system for normal operation.</p>
E18 CHECK CIRCUIT 22 (LB/BK) FOR SHORT TO GROUND	
<p>1</p>  <p>Fuse Junction Panel C243</p>	
<p>2</p>  <p>GK8121-A</p>	<p>2 Measure the resistance between brake pedal position (BPP) switch C279-3, circuit 22 (LB/BK), and ground.</p>
	<ul style="list-style-type: none"> • Is the resistance greater than 10,000 ohms? <p>→ Yes REPLACE the BPP switch. TEST the system for normal operation.</p> <p>→ No REPAIR circuit 22 (LB/BK). TEST the system for normal operation.</p>

Component Test

Relay — Micro ISO

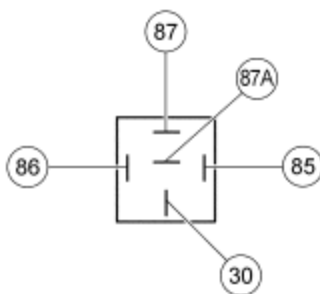
Use 73 Digital Multimeter to check for continuity between terminal 2 and all other terminals. If resistance is 5 ohms or less between terminal 2 and any other terminal, replace the relay. If resistance is greater than 5 ohms, continue with the test. Use two jumper wires to connect relay terminals 1 and 3 directly to the positive battery terminal. With 73 Digital Multimeter set in volts position, check for voltage at terminal 4. If battery voltage is not indicated, replace the relay. If battery voltage is indicated, connect a third jumper wire to terminal 2 and ground the jumper wire to a known good ground. Check for voltage at terminal 5. If battery voltage is not indicated, replace the relay.



GK2145-A

Relay — Mini ISO

Use 73 Digital Multimeter to check for continuity between terminal 85 and all other terminals. If resistance is 5 ohms or less between terminal 85 and any other terminal, replace the relay. If resistance is greater than 5 ohms, continue with the test. Use two jumper wires to connect relay terminals 86 and 30 directly to the positive battery terminal. Use 73 Digital Multimeter set in the volts position to check for voltage at terminal 87A. If battery voltage is not indicated, replace the relay. If battery voltage is indicated, connect a third jumper wire to terminal 85 and ground the jumper wire to a known good ground. Check for voltage at terminal 87. If battery voltage is not indicated, replace the relay.



GK4412-A

SECTION 308-07B:
Transfer Case

[SPECIFICATIONS](#)

DESCRIPTION AND OPERATION

[Transfer Case](#)

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[Transfer Case](#)

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[Transfer Case Draining and Filling](#)

IN-VEHICLE REPAIR

[Seal—Rear Output](#)

[Seal—Front Output](#)

[Transfer Case Shift Lever](#)

[Shift Switch](#)

[Indicator Switch—Three Position](#)

[Transfer Case Shift Motor](#)

DISASSEMBLY AND ASSEMBLY

[Transfer Case](#)

REMOVAL

[Transfer Case](#)

INSTALLATION

[Transfer Case](#)

SECTION 308-07B: Transfer Case
SPECIFICATIONS

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[Procedure revision date: 01/26/2000](#)

General Specifications	
Item	Specification
Fluids	
Multi-Purpose Grease DOAZ-19584-AA	ESB-M1C93-B and ESR-M1C159-A
Motorcraft MERCON® Multi-Purpose ATF XT-2-QDX	MERCON®
Sealants	
Pipe Sealant with Teflon® D8AZ-19554-A	WSK-M2G350-A2 and ESR-M18P7-A
Silicone Rubber F4AZ-19562-B	WSE-M4G323-A1
Cleaner	
Metal Surface Cleaner F4A3-19A536-RA	WSE-M5B392-A

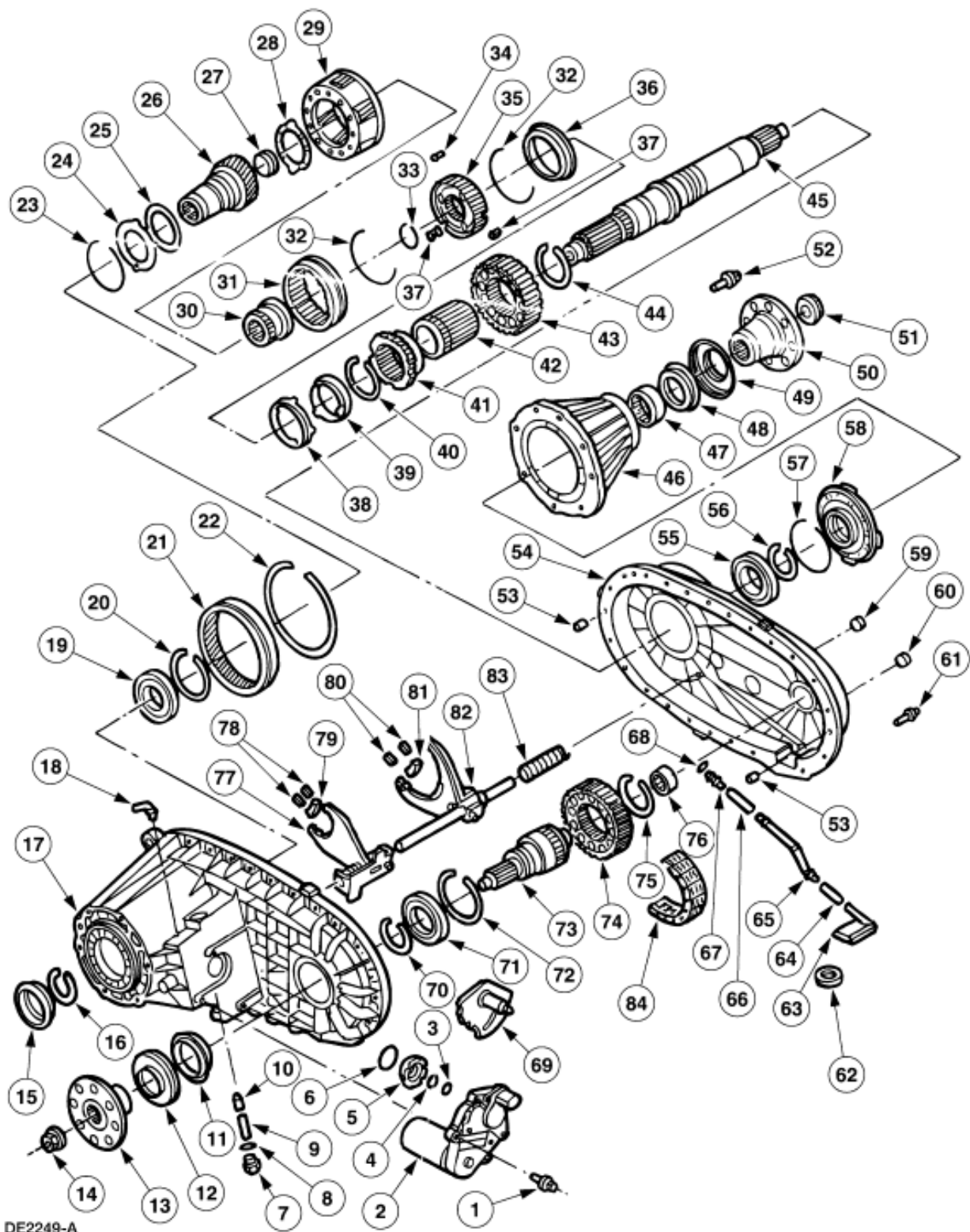
Torque Specifications		
Description	Nm	lb-ft
Transfer case control lever assembly bolts	115	85
Shift lever-to-control lever assembly bolt	28	21
Sector support	31	23
Poppet screw	20	15
Case bolts	31	23
Case bolts at dowel	24	18
Front output nut	223	165
Rear output nut	251	186
Shift lever nut	20	15
Shift motor bolts	20	15
Three position indicator switch	27	20
Drain and fill plugs	27	20
Transfer case mounting bolts	50	37

Transfer Case

The New Venture Gear transfer cases are either manual or electric shift. These transfer cases are specifically designed to withstand high engine torque loads under all modes of operation.

When in the 4 x 4 mode of operation, torque is transferred from the main input shaft through a high load capacity chain link belt to the transfer case front output shaft. The front output driveshaft then transfers this torque to the front differential.

Electric Shift Transfer Case



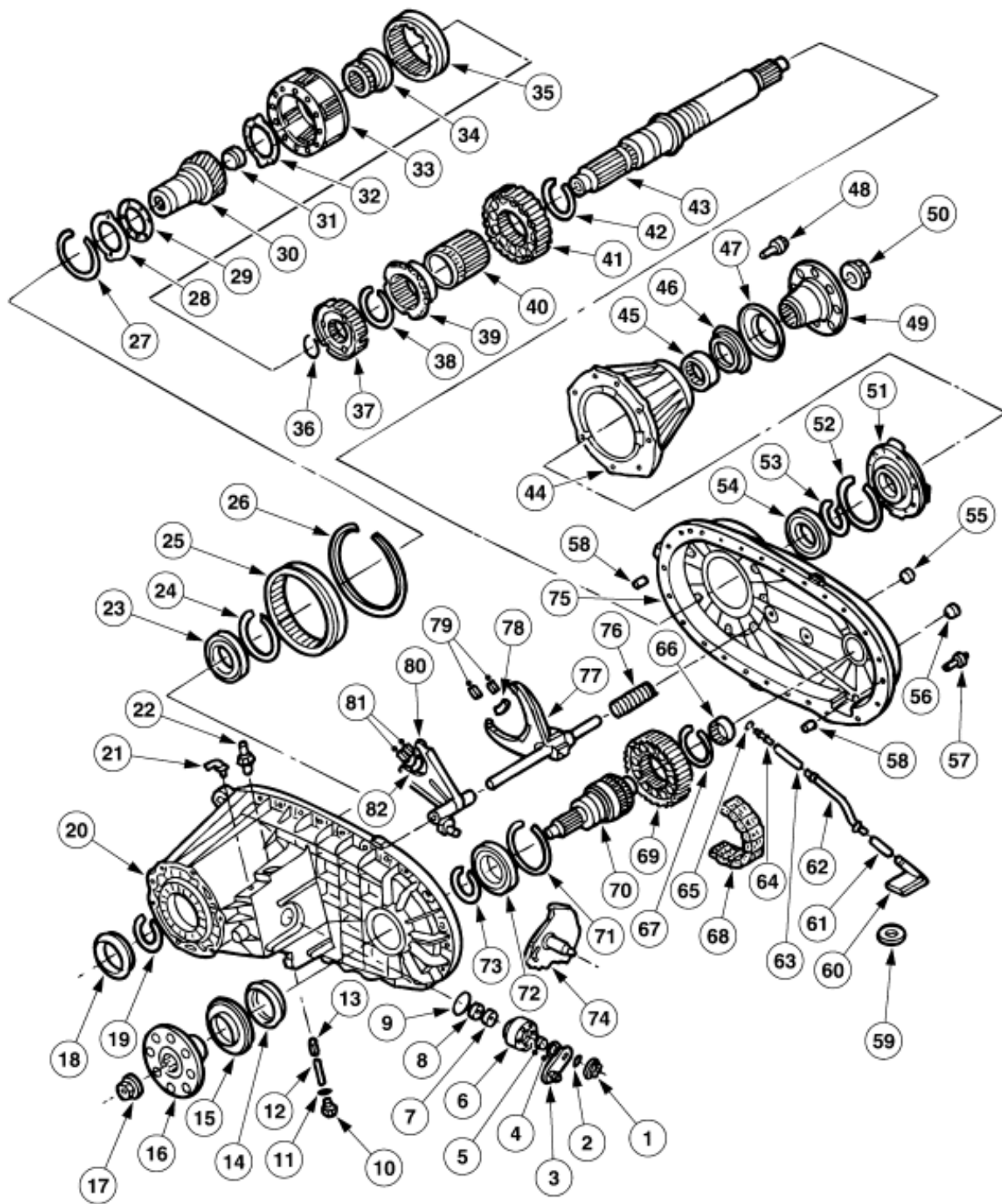
Item	Description
1	Bolt
2	Gearmotor Encoder Assy

3	Plastic Retainer
4	O-Ring Motor Seal
5	Motor Adapter
6	O-Ring Support Seal
7	Poppet Screw
8	O-Ring Seal
9	Spring
10	Poppet
11	Front Output Seal
12	Slinger
13	Front Flange
14	Hex Lock Nut
15	Input Seal
16	Input Bearing Retaining Ring
17	Front Half Case
18	Vent
19	Ball Bearing, Front Input
20	Front Input Bearing Retaining Ring
21	Annulus Gear
22	Annulus Retaining Ring
23	Lock Plate Retaining Ring
24	Lock Plate
25	Front Input Gear Thrust Washer
26	Input Gear
27	Pilot Bearing
28	Rear Input Gear Thrust Washer
29	Planetary Carrier Assy
30	Range Shift Sleeve
31	Synchronizer Sleeve
32	Synchronizer Spring
33	Hub Retaining Ring
34	Synchronizer Strut
35	Synchronizer Hub
36	Outer Ring
37	Synchronizer Strut

38	Middle Ring
39	Inner Ring
40	Clutch Gear Retaining Ring
41	Clutch Gear
42	Drive Sprocket Hub
43	Drive Sprocket
44	Sprocket Retaining Ring
45	Mainshaft
46	Rear Retainer
47	Needle Bearing
48	Rear Output Seal
49	Slinger
50	Rear Flange
51	Nut
52	Retainer Bolt
53	Bushing Dowel
54	Rear Half Case
55	Ball Bearing
56	Retaining Ring
57	Retaining Ring
58	Oil Pump Assy
59	Fill Plug
60	Drain Plug
61	Rear Case Bolt
62	Chip Collector Magnet
63	Oil Screen
64	Lower Tube Connector
65	Lower Oil Tube
66	Upper Tube Connector
67	Upper Oil Tube
68	O-Ring Seal
69	Sector Assy
70	Front Oil Pump Retaining Ring
71	Front Oil Pump Ball Bearing
72	Retaining Ring

73	Front Output Shaft
74	Driven Sprocket
75	Sprocket Retaining Ring
76	Needle Bearing
77	Range Fork Assy
78	Range Shift Fork End Pad
79	Range Shift Fork Center Pad
80	Mode Fork End Pad
81	Mode Fork Center Pad
82	Mode Fork Assy
83	Mode Spring
84	Drive Chain

Mechanical Shift Transfer Case



DE2292-B

Item	Description
1	Locknut, Lever
2	Washer, Lever
3	Lever ASM

4	Spacer, Lever
5	Sector Support Seal
6	Sector Shaft Support
7	Support Bearing
8	Support Bearing
9	O-Ring Sector Support
10	Poppet Screw
11	O-Ring Seal
12	Spring
13	Poppet
14	Front Output Seal
15	Slinger
16	Front Flange
17	Hex Lock Nut
18	Input Seal
19	Input Bearing Retaining Ring
20	Front Half Case
21	Vent
22	Precision 3 Position Switch
23	Ball Bearing, Front Input
24	Front Input Bearing Retaining Ring
25	Annular Gear
26	Annulus Retaining Ring
27	Lock Plate Retaining Ring
28	Lock Plate
29	Front Input Gear Thrust Washer
30	Input Gear
31	Pilot Bearing
32	Rear Input Gear Thrust Washer
33	Planetary Carrier Assy
34	Range Shift Sleeve
35	Synchronizer Sleeve
36	Hub Retaining Ring
37	Synchronizer Hub
38	Clutch Gear Retaining Ring

39	Clutch Gear
40	Drive Sprocket Hub
41	Drive Sprocket
42	Sprocket Retaining Ring
43	Mainshaft
44	Rear Retainer
45	Needle Bearing
46	Rear Output Seal
47	Slinger
48	Retainer Bolt
49	Rear Flange
50	Nut
51	Oil Pump Assy
52	Retaining Ring
53	Retaining Ring
54	Ball Bearing
55	Fill Plug
56	Drain Plug
57	Rear Case Bolt
58	Dowel Bushing
59	Chip Collector Magnet
60	Oil Screen
61	Lower Tube Connector
62	Lower Oil Tube
63	Upper Tube Connector
64	Upper Oil Tube
65	O-Ring Seal
66	Needle Bearing
67	Sprocket Retaining Ring
68	Drive Chain
69	Driven Sprocket
70	Front Output Shaft
71	Retaining Ring
72	Front Oil Pump Ball Bearing
73	Front Oil Pump Retaining Ring

74	Sector Assy
75	Rear Case Half
76	Mode Spring
77	Mode Fork Assy
78	Mode Fork Center Pad
79	Mode Fork End Pad
80	Range Fork Assy
81	Range Shift Fork End Pad
82	Range Shift Fork Center Pad

SECTION 308-07B: Transfer Case
DIAGNOSIS AND TESTING

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[Procedure revision date: 01/26/2000](#)

Transfer Case

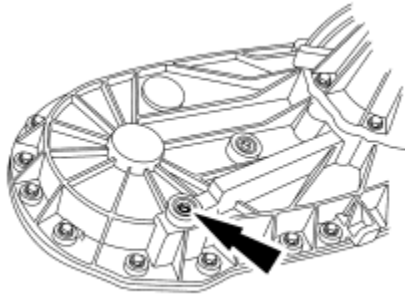
Refer to [Section 308-07A](#).

SECTION 308-07B: Transfer Case
GENERAL PROCEDURES

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Transfer Case Draining and Filling

1. Position a suitable container under the transfer case.
2. Remove the drain plug and drain the transfer case.



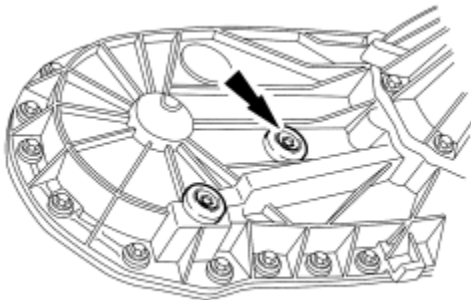
A0037548

3.  **CAUTION:** If the correct fill procedures are not followed, a transfer case failure can result.

NOTE: Fluid level must be just below the fill plug.

Remove the fill plug from the rear of the transfer case and check the fluid level.

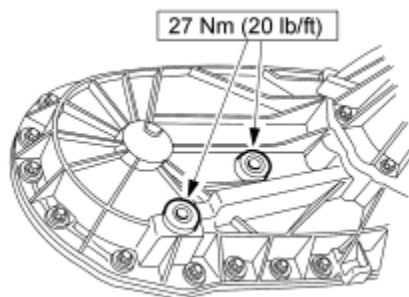
- If the fluid is below the level, fill with Motorcraft MERCON® Multi-Purpose Automatic Transmission Fluid XT-2-QDX or MERCON® equivalent.



DE2252-A


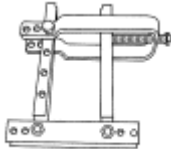


4.  **CAUTION:** Do not use air tools.

Tighten the drain and fill plugs.




DE1845-A

Seal—Rear Output

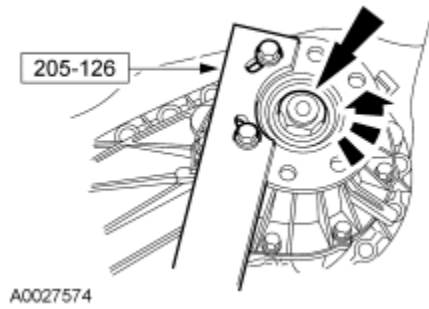
Special Tool(s)	
 ST1257-A	Holding Fixture, Drive Pinion Flange 205-126 (T78P-4851-A)
 ST1758-A	Remover, Torque Converter Oil Seal 307-309 (T94P-77001-BH)
 ST1255-A	Adapter for 303-224 (Handle) 205-153 (T80T-4000-W)
 ST2233-A	Installer, Output Shaft Seal 308-403

Removal

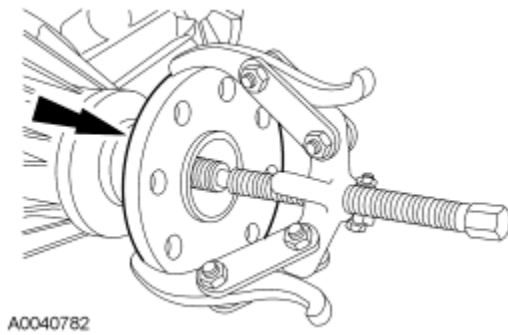
1. With the vehicle in NEUTRAL, raise and support the vehicle. For additional information, refer to [Section 100-02](#).
2.  **CAUTION: Index mark the driveshaft to the flange to maintain proper driveline balance.**

Disconnect the rear driveshaft at the transfer case and position it aside. For additional information, refer to [Section 205-01](#).

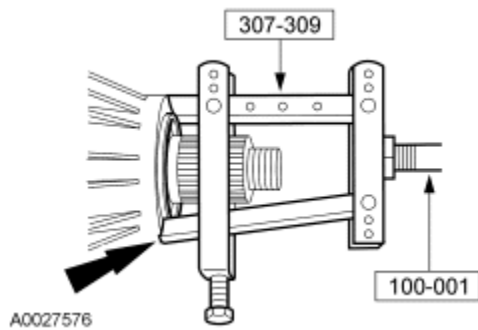
3. While using the Companion Flange Holding Tool to prevent the flange from turning, remove and discard the nut.



4. Using a suitable 2- or 3-jaw puller, remove the flange.



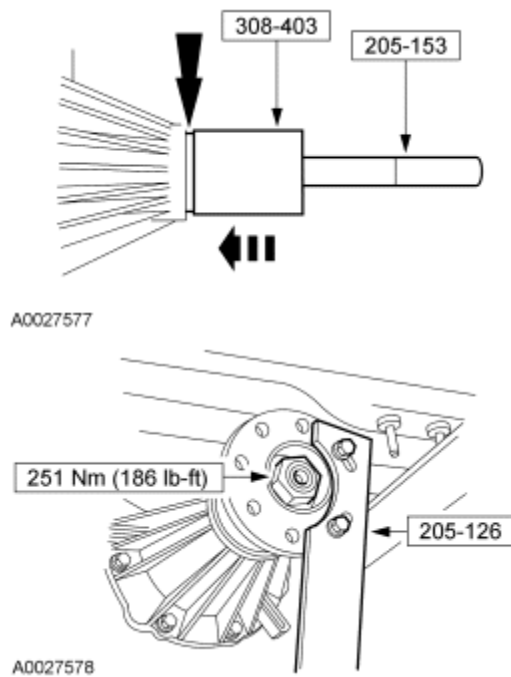
5. Using the special tools, remove the rear output seal.



6. Inspect the flange seal surface for wear and replace the rear retainer if necessary.

Installation



1. Follow the removal procedure in reverse order.
 - Using the special tools, install a new output seal.



SECTION 308-07B: Transfer Case
IN-VEHICLE REPAIR

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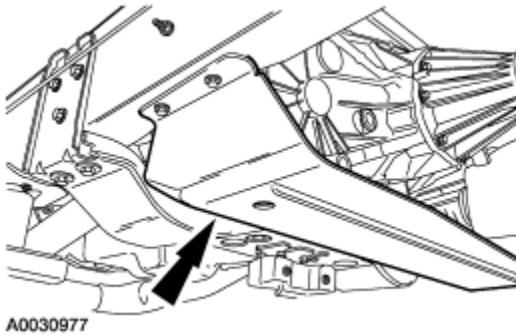
Seal—Front Output

Special Tool(s)	
 ST1255-A	Adapter for 303-224 (Handle) 205-153 (T80T-4000-W)
 ST1257-A	Holding Fixture, Drive Pinion Flange 205-126 (T78P-4851-A)

 <p>ST2233-A</p>	<p>Installer, Output Shaft Oil Seal 308-403</p>
 <p>ST1758-A</p>	<p>Remover, Torque Converter Oil Seal 307-309 (T94P-77001-BH)</p>
 <p>ST1185-A</p>	<p>Slide Hammer 100-001 (T50T-100-A)</p>

Removal

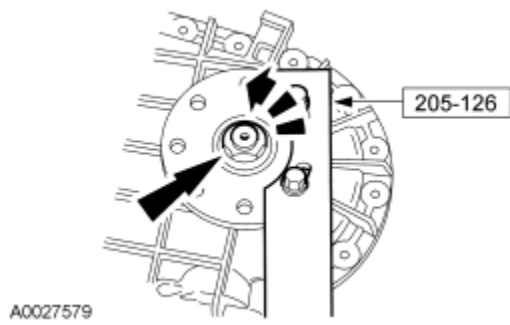
1. With the vehicle in NEUTRAL, raise and support the vehicle. For additional information, refer to [Section 100-02](#).
2. Remove the skid plate, if equipped.



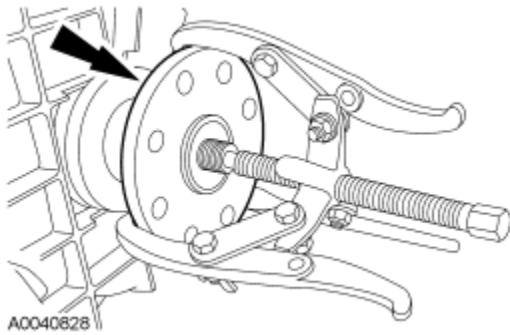
3. **NOTE:** Index-mark the front driveshaft and the transfer case front flange to maintain driveline balance.

Remove the front driveshaft. For additional information, refer to [Section 205-01](#).

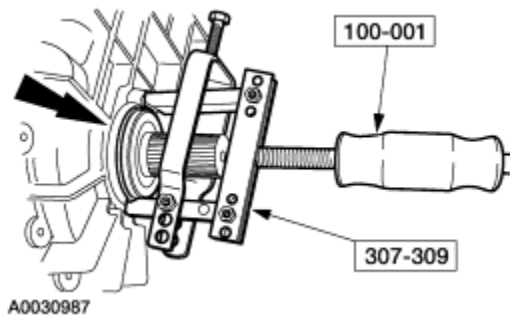
4. Remove and discard the nut.
 - Use the special tool to prevent the flange from turning.



5. Using a suitable 2- or 3-jaw puller, remove the flange.



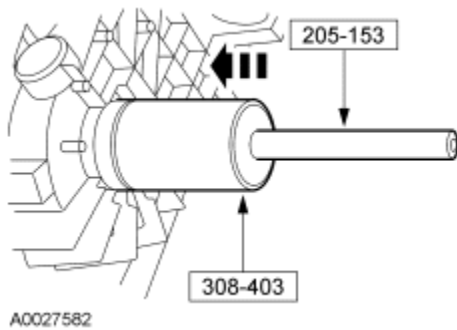
6. Using the special tools, remove the front output seal.



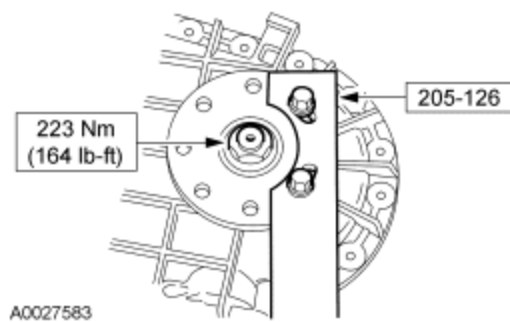
7. Inspect the flange seal surface for wear and damage. Discard the flange, if necessary.

Installation

1. Using the special tools, install a new front output seal.



2. Install the front flange.
 - Use the special tool to prevent the flange from turning while installing a new nut.



3. **⚠ CAUTION: Align the index marks.**

Install the front driveshaft. For additional information, refer to [Section 205-01](#).

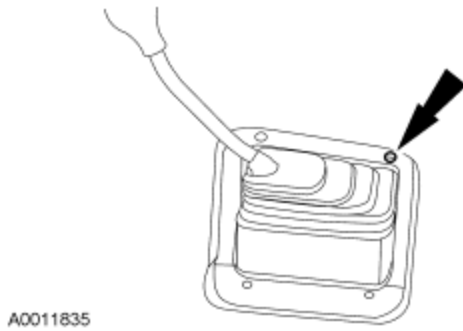
4. Check and, if necessary, fill the transfer case with the specified fluid to the specified level. For additional information, refer to [Transfer Case Draining and Filling](#) in this section.
5. Lower the vehicle.

Transfer Case Shift Lever

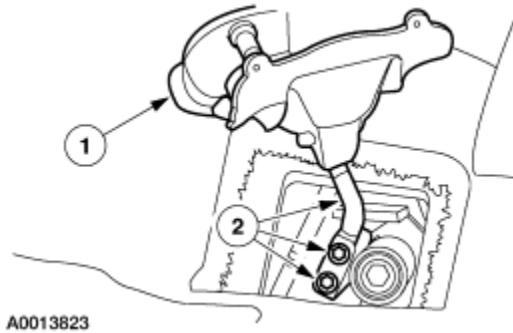
Removal

1. Shift the transfer case into 4H.

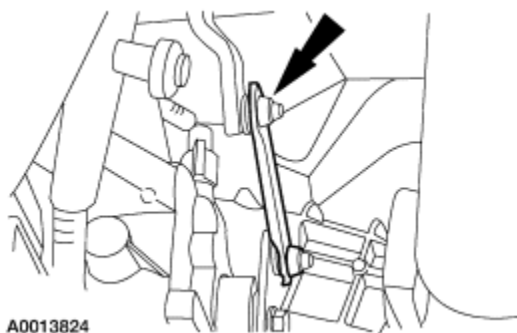
2. Remove the screws that attach the bezel and boot assembly to the floor.



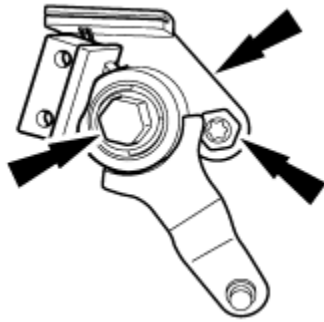
3. Remove the bolts that attach the shift lever to the transfer case control lever assembly, and remove the shift lever, and the bezel and boot assembly.
 1. Slide the bezel and boot assembly upward on the shift lever.
 2. Remove the bolt, the shift lever, and the bezel and boot assembly.



4. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
5. Disconnect the control rod from the lower shifter arm.




6. Remove the bolts and the transfer case control lever assembly.

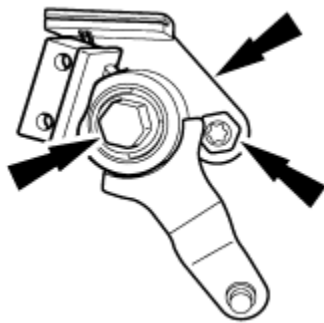


A0013825

Installation


1.  **CAUTION: Do not tighten the bolts that attach the transfer case control lever assembly to the transmission case at this time.**

Position the transfer case control lever assembly and start the bolts into the threaded holes by hand.

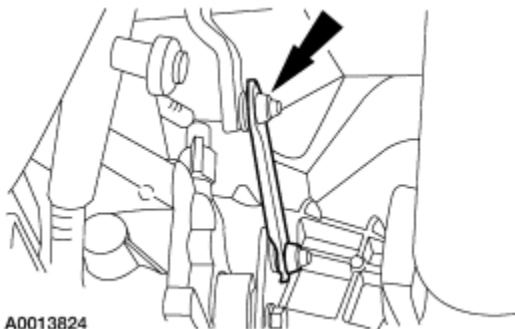


A0013825

2.  **CAUTION: Verify that the control rod is still attached correctly to the transfer case.**

 **CAUTION: Verify that the transfer case is still in 4H.**

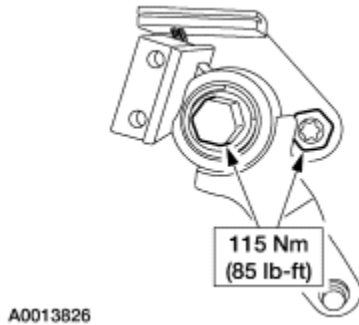
Connect the control rod to the lower shifter arm.



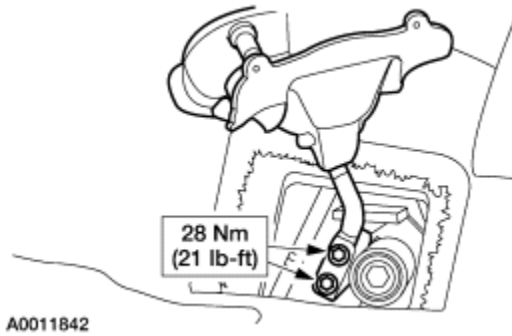
A0013824

3.  **CAUTION: Hold the control lever against the 4H detent while tightening the bolts. This will ensure correct transfer case gear engagement during transfer case operation.**

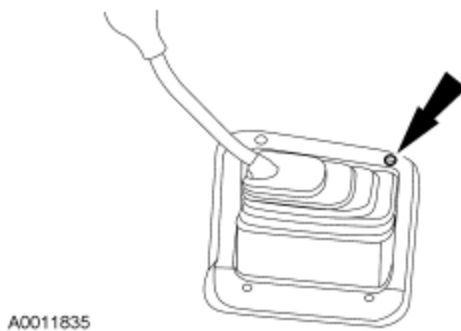
Hold the control lever against the 4H detent while tightening the bolts.



4. Lower the vehicle.
5. Position the shift lever with the bezel and boot assembly and install the bolts.



6. Position the bezel and boot assembly and install the screws.

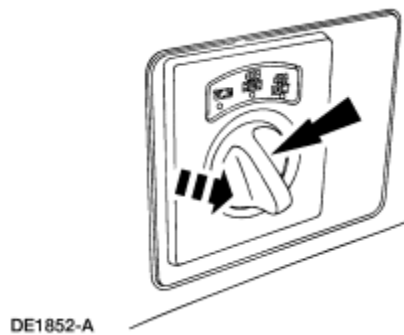


7. Verify the shift sequence from 2H to 4L to 2H.
-

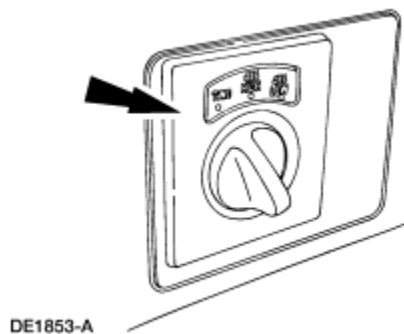
Shift Switch

Removal

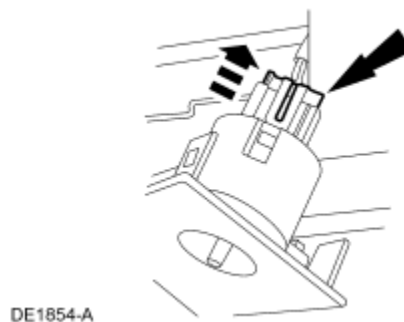
1. Remove the shift switch knob.



2. Remove the switch plate.



3. Disconnect the wiring harness connector.



4. Remove the two screws and the switch.



DE1855-A

Installation

1. Follow the removal procedure in reverse order.

SECTION 308-07B: Transfer Case
IN-VEHICLE REPAIR

1999 F-Super Duty 250-550 Workshop Manual

[Procedure revision date: 01/26/2000](#)

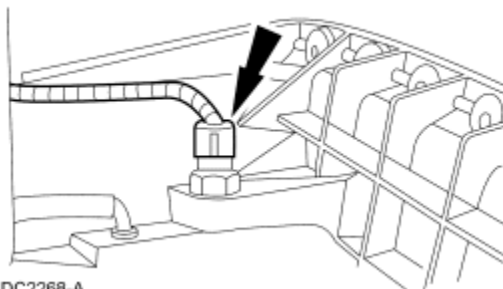
Indicator Switch—Three Position

Removal

1. **NOTE:** On the electric shift transfer case, the position indicator switch is integral to the gearmotor encoder assembly. For additional information, refer to [Transfer Case Shift Motor](#) in this section for replacement procedure.

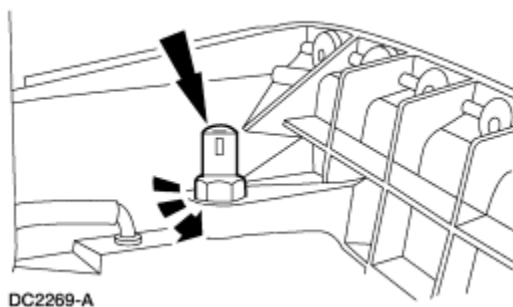
Raise and support the vehicle; for additional information, refer to [Section 100-02](#).

2. Disconnect the wiring harness connector.



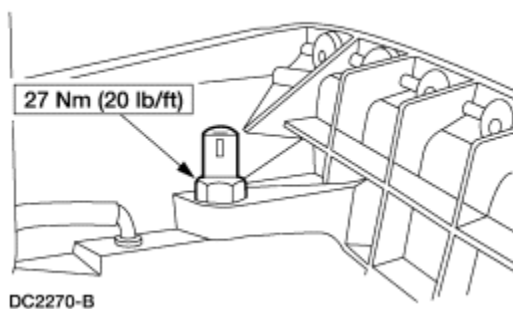
DC2268-A

3. Remove the 3 position switch.



Installation

1. Follow the removal procedure in reverse order.



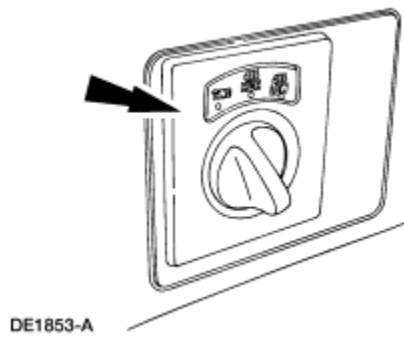
SECTION 308-07B: Transfer Case
IN-VEHICLE REPAIR

1999 F-Super Duty 250-550 Workshop Manual
[Procedure revision date: 01/26/2000](#)

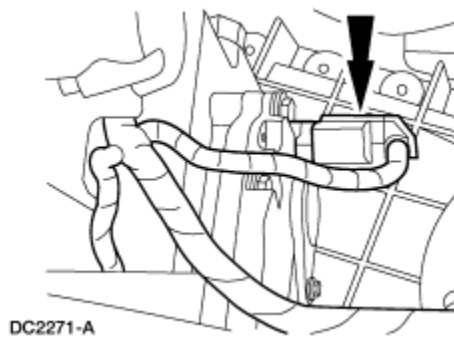
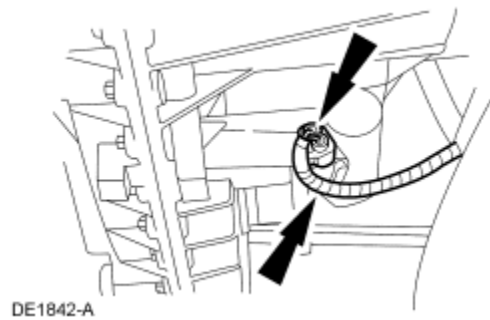
Transfer Case Shift Motor

Removal

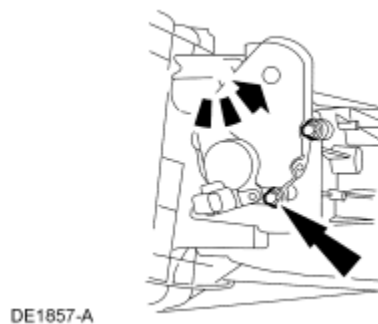
1. Set the selector switch to the 2W HI range position.



2. Raise and support the vehicle; for additional information, refer to [Section 100-02](#).
3. Disconnect the gearmotor encoder assembly harness connectors.



4. Remove the three retaining bolts and the gearmotor encoder assembly.
 - The gearmotor encoder assembly is not repairable and must be replaced as an assembly.

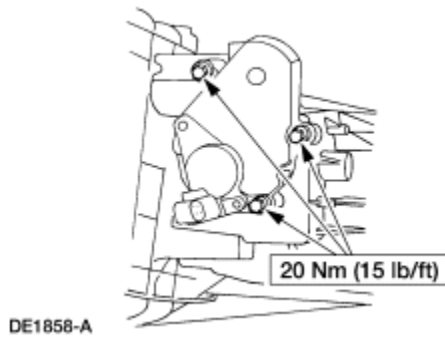


5. Remove the grease from the motor adapter and check for nicks or burrs.

Installation

1. **NOTE:** Apply a coat of Multi-Purpose Grease DOAZ-19584-AA meeting Ford specifications ESB-M1C93-B and ESR-M1C159-A or equivalent to the motor adapter.

Follow the removal procedure in reverse order.






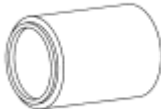




SECTION 308-07B: Transfer Case
DISASSEMBLY AND ASSEMBLY

1999 F-Super Duty 250-550 Workshop Manual
[Procedure revision date: 01/26/2000](#)

Transfer Case

Special Tool(s)	
 ST1186-A	Holding Fixture, Transmission 307-003 (T57L-500-B)
 ST1144-A	Universal Puller Set 303-DS005 (D80L-100-A)

 <p>ST1257-A</p>	<p>Holding Fixture, Drive Pinion Flange 205-126 (T78P-4851-A)</p>
 <p>ST1758-A</p>	<p>Remover, Torque Converter Oil Seal 307-309 (T94P-77001-BH)</p>
 <p>ST2232-A</p>	<p>Installer, Transfer Case Needle Bearing 308-402</p>
 <p>ST2229-A</p>	<p>Installer, Front Shaft Oil Slinger 308-399 (Part of Kit 308-S398)</p>
 <p>ST2239-A</p>	<p>Installer, Output Shaft Front Bearing 308-410</p>
 <p>ST2235-A</p>	<p>Sleeve, Output Shaft Front Snap Ring 308-405</p>
 <p>ST1255-A</p>	<p>Adapter for 303-224 (Handle) 205-153 (T80T-4000-W)</p>
 <p>ST2239-A</p>	<p>Installer, Input Shaft Bearing 308-412</p>

 ST2238-A	Installer, Input Shaft Oil Seal 308-408
 ST2236-A	Sleeve, Input Shaft Snap Ring 308-406
 ST2231-A	Installer, Output Shaft Rear Bearing 308-401
 ST2233-A	Installer, Output Shaft Oil Seal 308-403
 ST2230-A	Installer, Output Shaft Oil Slinger 308-400 (Part of Kit 308-S398)
 ST1568-A	Installer, Drive Pinion Bearing Cup 205-138 (T80T-4000-D)
 ST1568-A	Installer, Drive Pinion Bearing Cup 205-140
 ST1880-A	Installer, Rear Axle Oil Seal 205-155

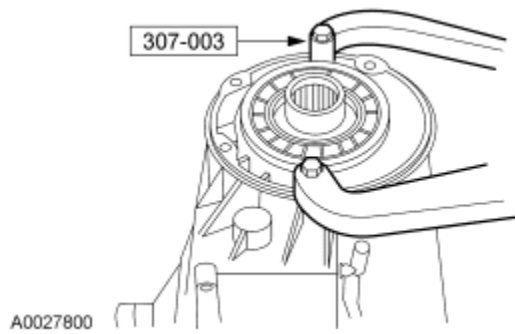
 ST2239-A	Installer, Output Shaft Bearing 308-411 (rear output ball bearing installation)
 ST2234-A	Sleeve, Output Shaft Rear Snap Ring 308-404
 ST2237-A	Socket, Sector Shaft Nut 308-407
 ST2227-A	Spreader, Transfer Case Housing 308-396

Material	
Item	Specification
Pipe Sealant with Teflon D8AZ-19554-A	WSK-M2G350-A2
Metal Surface Cleaner F4AZ-19A536-RA	WSE-M5B392-A
Silicone Gasket and Sealant F7AZ-19554-EA	WSE-M4G323-A4
Multi-Purpose Grease D0AZ-19554-AA	ESB-M1C93-B

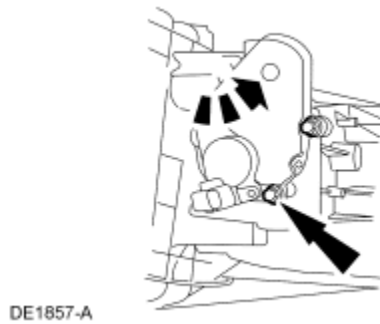
Disassembly

- 
CAUTION: During disassembly, all nuts, bolts and retaining rings are to be discarded and replaced with new components during assembly.

Mount the transfer case on a holding fixture.



2. On the electric shift transfer case, remove the gear motor encoder assembly.

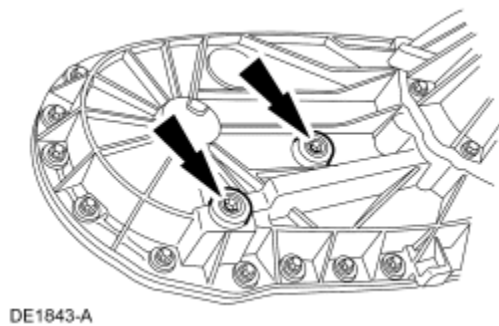


3. On the manual shift transfer case, remove the 3 position switch.

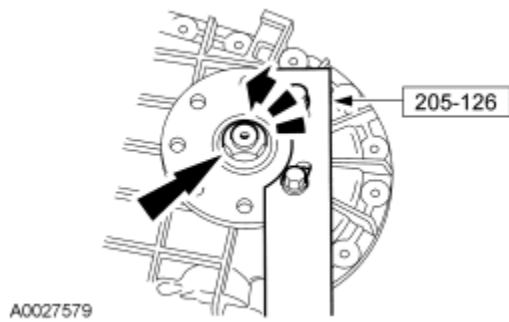


4.  **CAUTION: Do not use air tools to remove the plugs.**

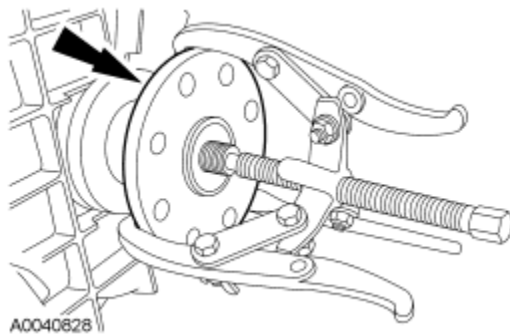
Remove the drain and fill plugs.



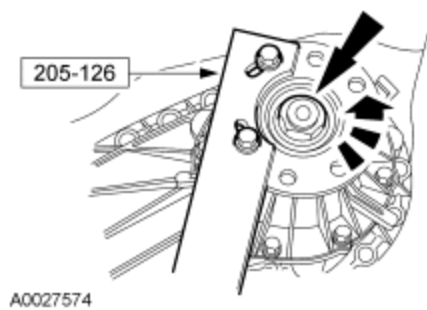
5. While using the special tool to prevent the flange from turning, remove and discard the nut.



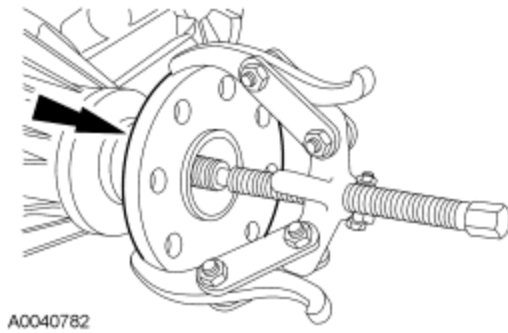
6. Using a suitable 2- or 3-jaw puller, remove the flange.



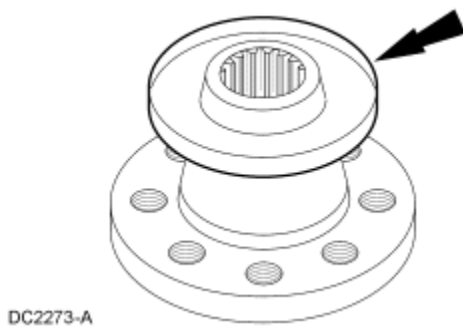
7. While using the special tool, to prevent the flange from turning, remove and discard the nut.



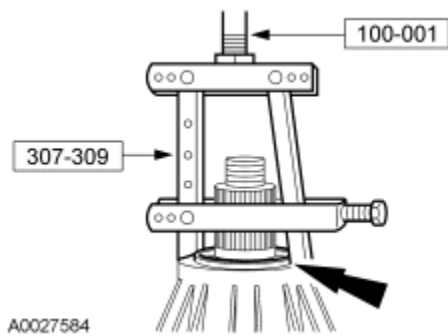
8. Using a suitable 2- or 3-jaw puller, remove the flange.



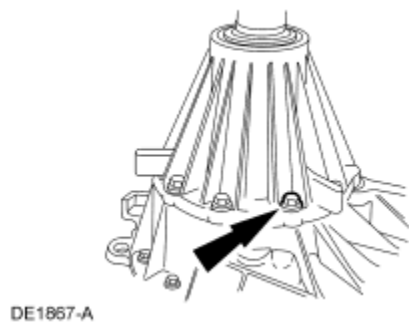
9. Remove the slinger from the front flange and the rear flange, if necessary.



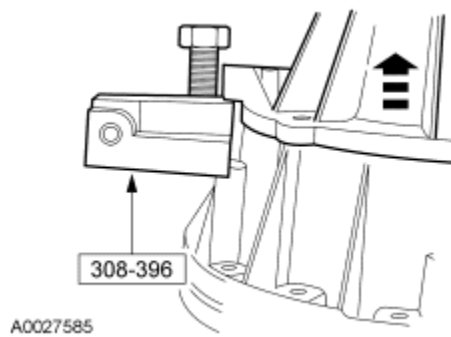
10. Using the special tool, remove the rear output seal.



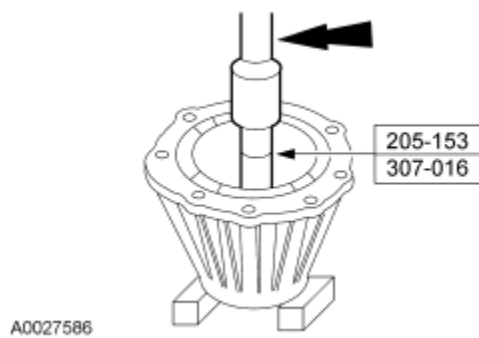
11. Remove and discard the rear bolts.



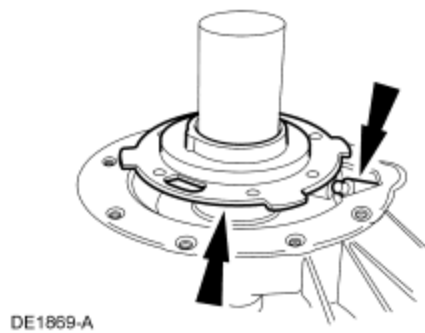
12. Using the special tool, remove the rear retainer.



13. Using the special tools and a suitable press, remove the needle bearing.

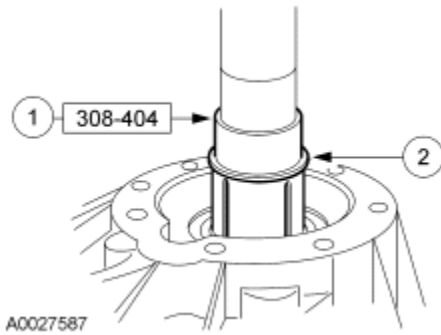


14. Disconnect the oil tube and remove the oil pump assembly.

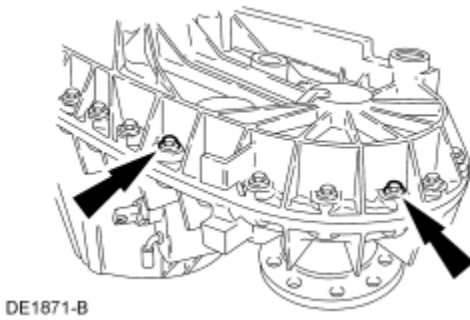


15. Remove the retaining ring.

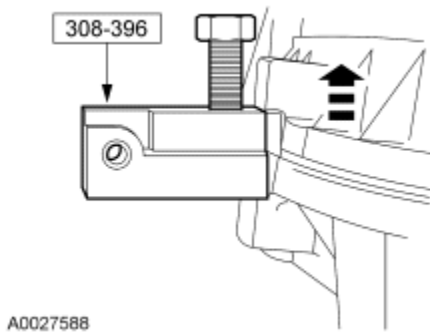
1. Install the special tool.
 2. Lift up on the shaft, and remove and discard the retaining ring.
- Remove the special tool.



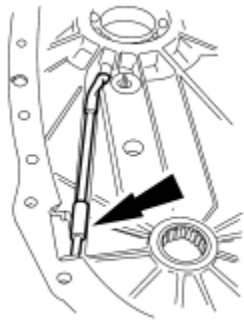
16. Remove and discard the 25 case bolts.



17. Using the special tool, separate the case halves. Remove the rear case.

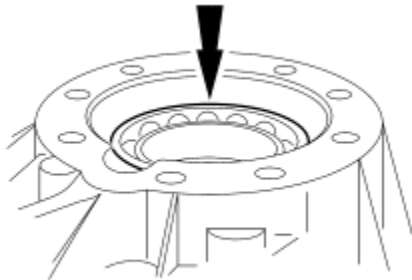


18. Remove the oil tube.



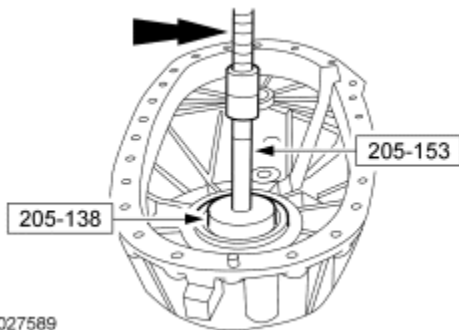
DE1873-A

19. Remove the ball bearing retaining ring.



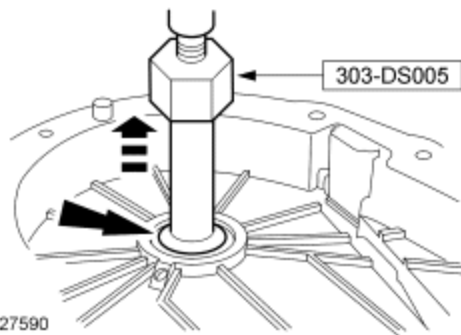
DC2276-A

20. Using the special tools and a suitable press, remove the ball bearing.



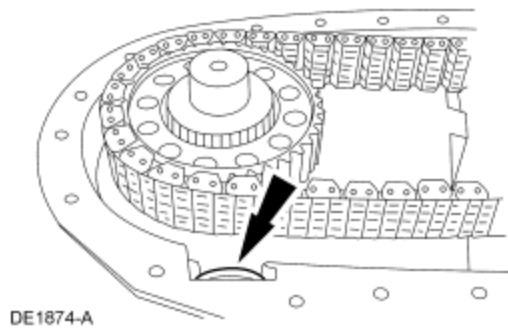
A0027589

21. Using the special tool, remove the needle bearing.

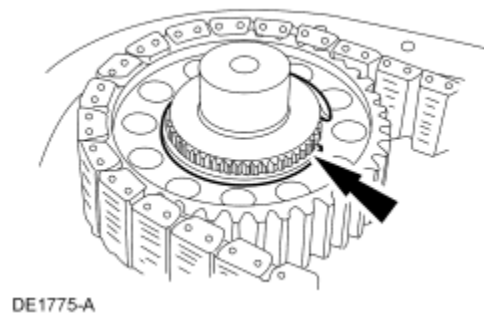


A0027590

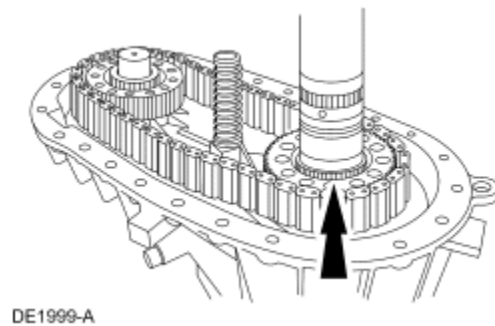
22. Remove the chip collector magnet.



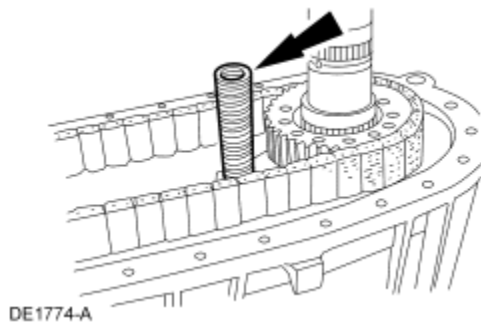
23. Remove the driven sprocket retaining ring.



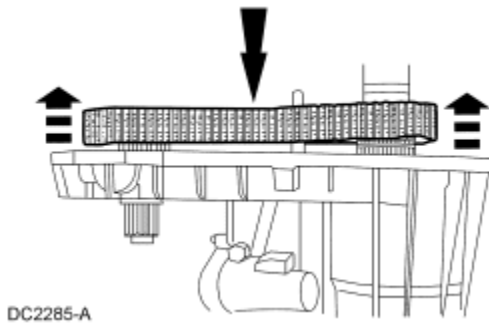
24. Remove the drive sprocket retaining ring.



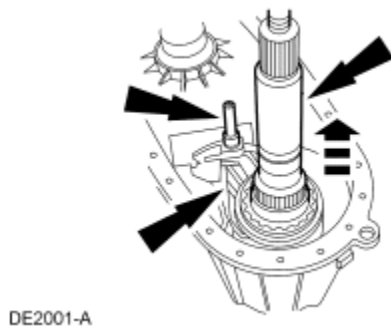
25. Remove the mode spring.



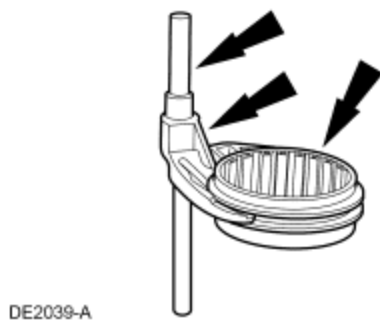
26. Remove the sprockets and chain as an assembly.



27. Remove the mainshaft and mode fork assembly as an assembly.

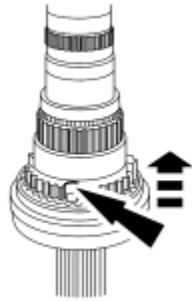


28. Slide the mode fork and synchronizer sleeve off of the mainshaft, and separate the components.



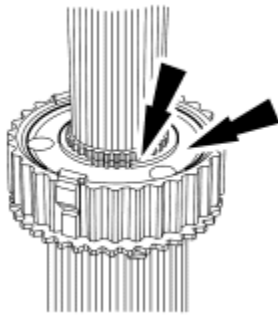
29. Place the mainshaft in a soft jawed vise with the threaded end up.

30. Remove the clutch gear.



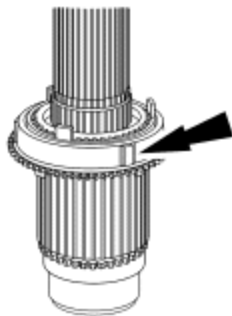
DE2002-A

31. Remove the retaining ring and the synchronizer hub.



DE2010-A

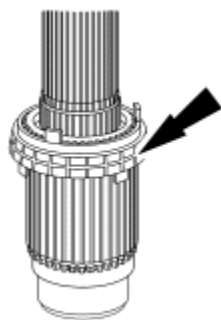
32. On the electric shift transfer case mainshaft, remove the outer ring.



DE2011-A

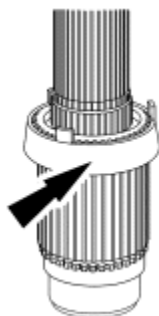
33. On the electric shift transfer case mainshaft, remove the middle ring.

DE2012-A



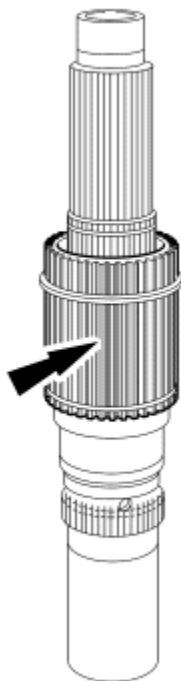
34. On the electric shift transfer case mainshaft, remove the inner ring.

DE2013-A



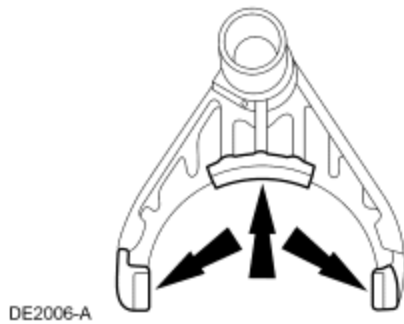
35. Remove the drive sprocket hub.

DE2014-A



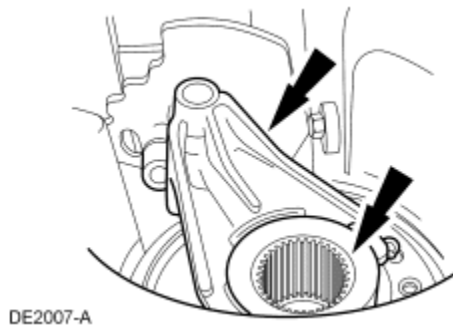
36. Inspect all of the components for wear and damage.

37. Inspect the mode fork pads for wear.

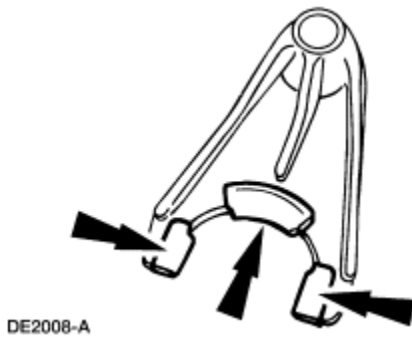


38. **NOTE:** Rotate the sector assembly to the 4-wheel high position for easy removal.

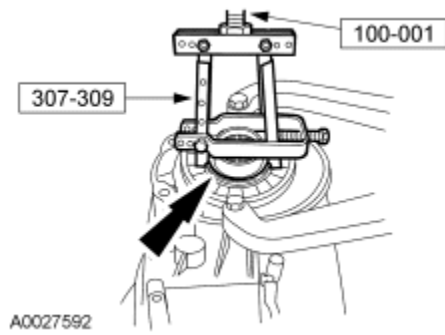
Remove the range fork assembly and the range shift sleeve.



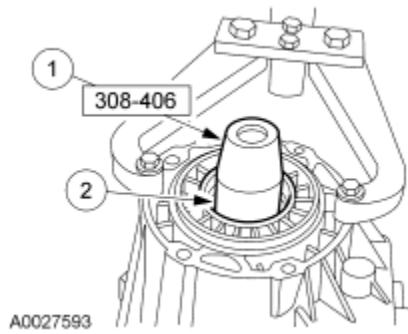
39. Inspect the range fork pads. If the pads are worn, discard the range fork, the pads, the mainshaft and the sleeve.



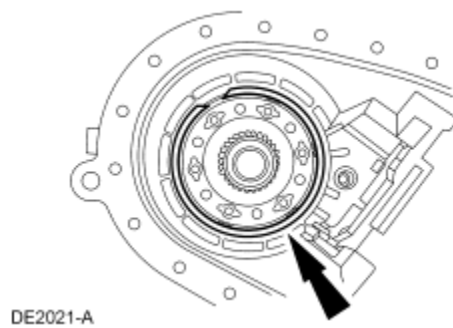
40. Using the special tool, remove the input seal.



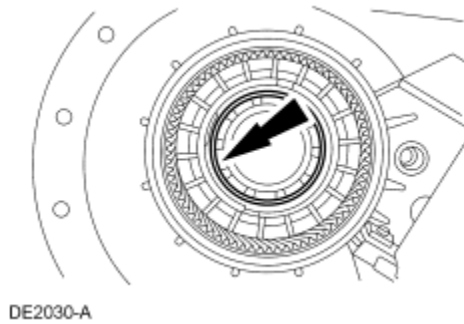
41. Remove the retaining ring.
1. Install the special tool.
 2. Remove and discard the retaining ring.



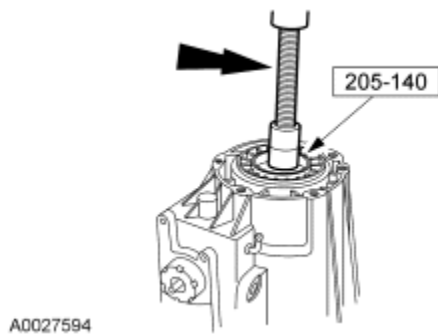
42. Remove the planetary assembly.



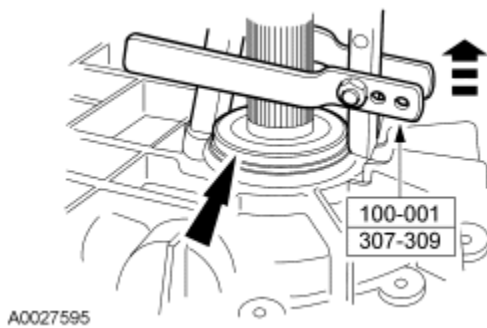
43. Remove the input bearing retaining ring.



44. Using the special tool and a suitable press, remove the front input bearing.

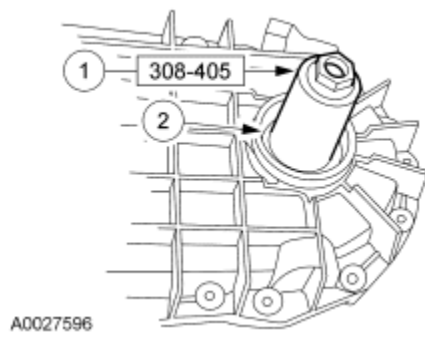


45. Using the special tool, remove the front output seal.

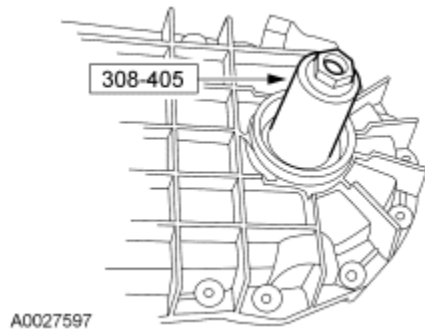


46. Remove the retaining ring.

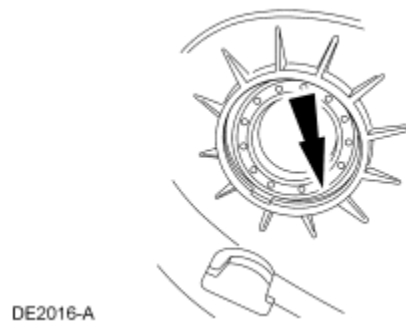
1. Install the special tool.
2. Remove and discard the retaining ring.



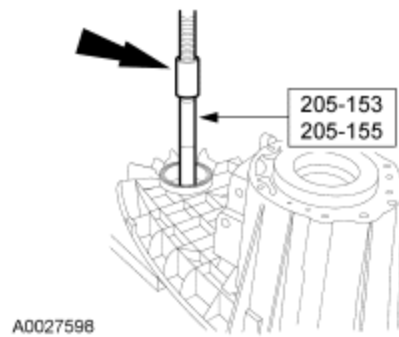
47. Remove the special tool and the front output shaft.



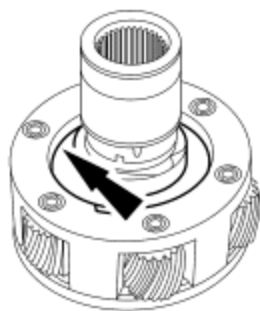
48. Remove the front output ball bearing retaining ring.



49. Using the special tools and a suitable press, remove the front output ball bearing.

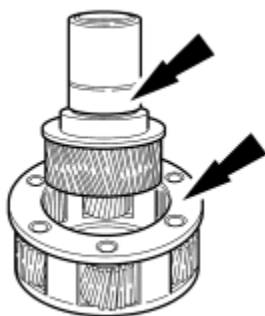


50. Remove the lock plate retaining ring.



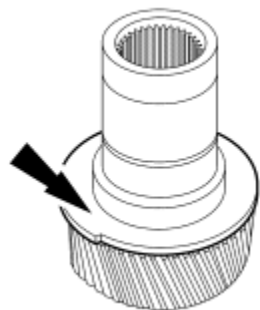
DE2022-A

51. Lift out the input gear from the planetary gear.



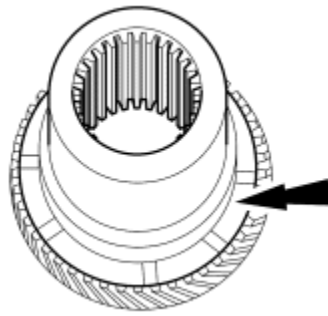
DE2023-A

52. Remove the lock plate.



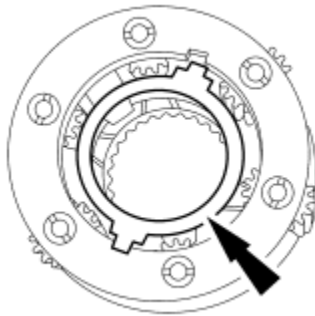
DE2024-A

53. Remove the front input gear thrust washer.



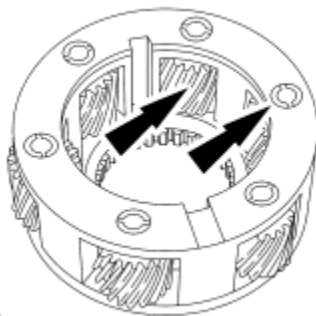
DE2025-A

54. Remove the rear input gear thrust washer.



DE2026-A

55. Inspect the gear teeth and thrust washers for wear or damage. Install a new planetary gear assembly, if necessary.



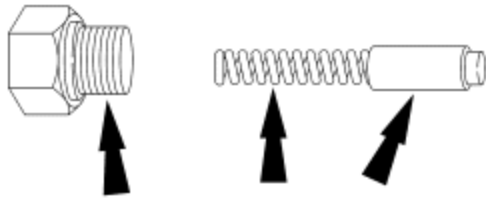
DE2027-A

56. Remove the poppet assembly.



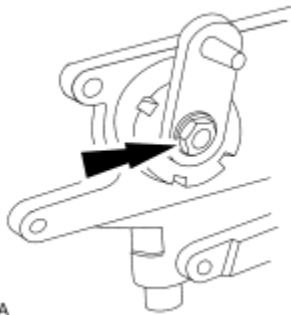
DE2028-A

57. Disassemble the poppet screw, spring and poppet.



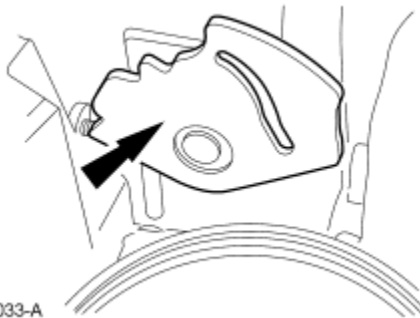
DE2029-B

58. On the manual shift transfer case, remove the locknut, washer, lever, spacer and the sector assembly.



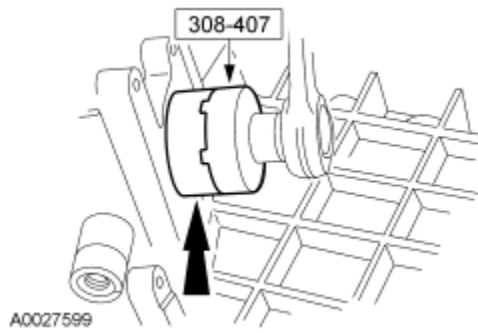
DC2282-A

59. On the electric shift transfer case, remove the plastic retainer and O-ring and remove the sector assembly.

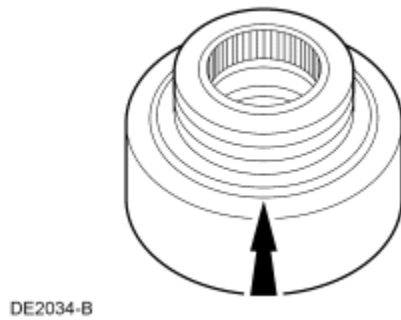


DE2033-A

60. Using the special tool, remove the sector shaft support (motor adapter for electric shift transfer case).

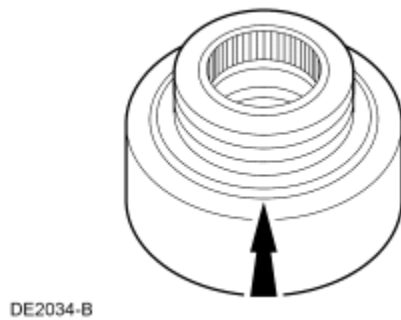


61. Remove and discard the support O-ring seal.



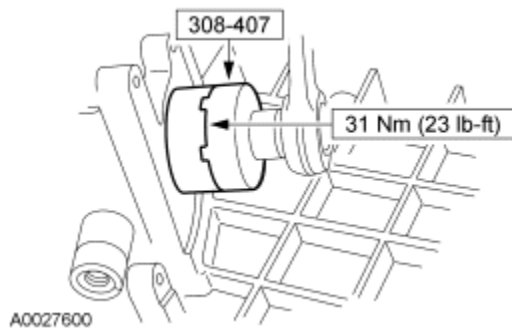
Assembly

1. Install a new support O-ring seal.

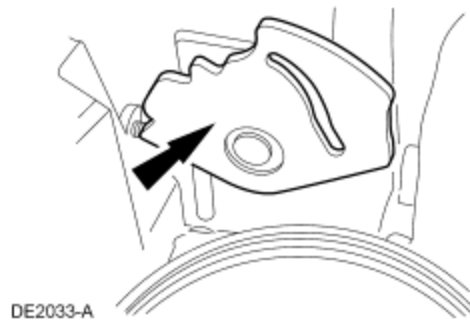


2. **NOTE:** Prior to assembly, coat the threads with pipe sealant.

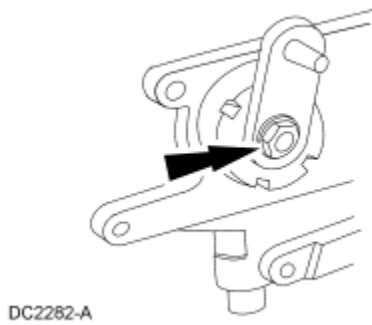
Using the special tool, install the sector shaft support (motor adapter for electric shift transfer case).



3. Install the sector assembly. On the electric shift transfer case, install the plastic retainer and O-ring.

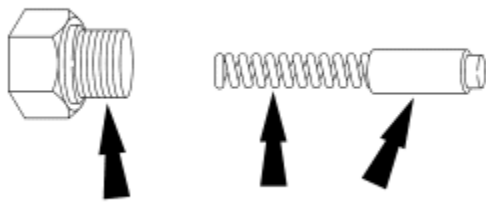


4. On the manual shift transfer case, install the spacer, lever, washer and the locknut.



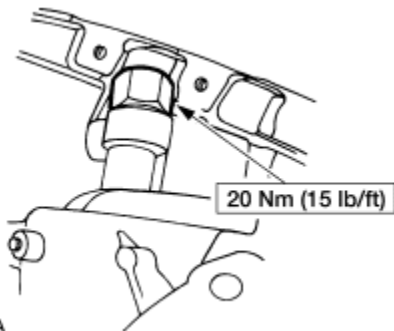
5. **NOTE:** If the poppet spring is being replaced, a like color spring must be used.

Assemble the poppet screw, spring and poppet.



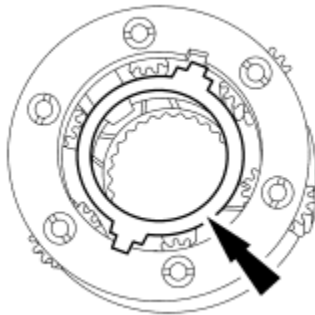
DE2029-B

6. Install the poppet assembly.



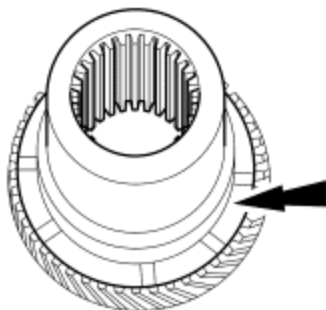
DE2037-A

7. Install the rear input gear thrust washer.



DE2026-A

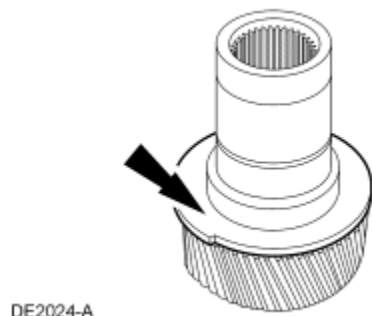
8. Install the front input gear thrust washer.



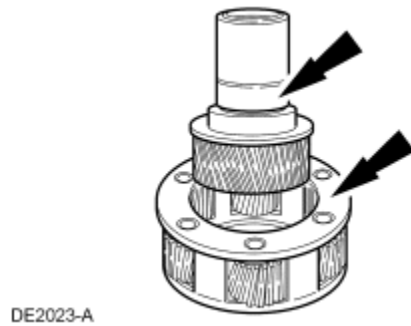
DE2025-A

9. **NOTE:** Install the lock plate with the stamped letter E facing outward.

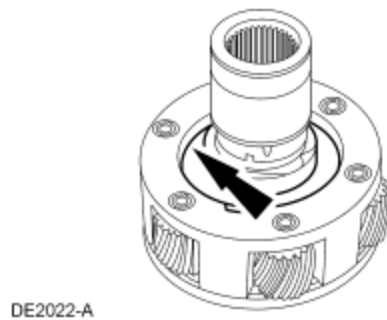
Install the lock plate.



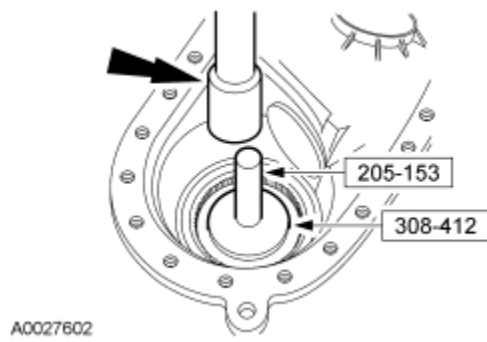
10. Place the input gear into the planetary carrier assembly.



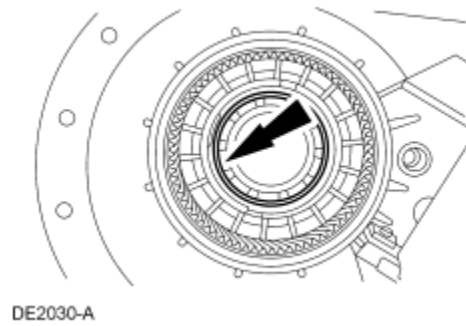
11. Install a new lock plate retaining ring.



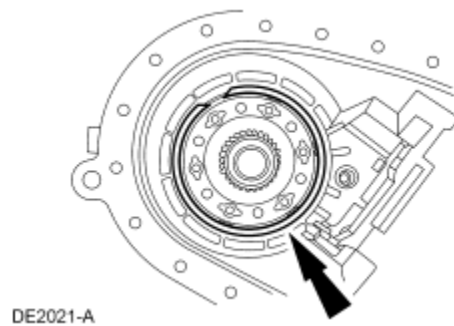
12. Using the special tools and a suitable press, install a new front input bearing.



13. Install a new bearing retainer ring.

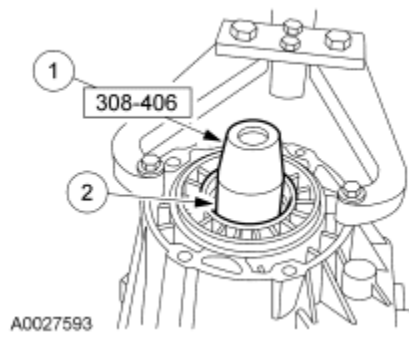


14. Position the planetary assembly into the front case.

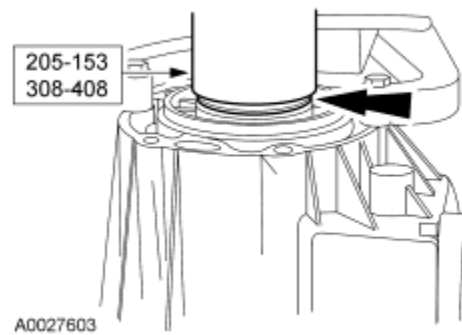


15. Install a new retaining ring.

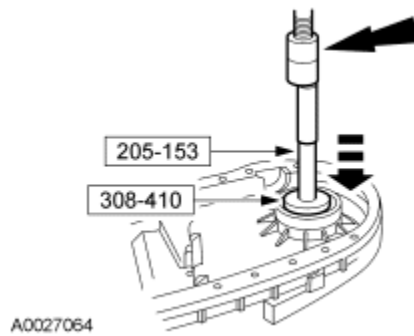
1. Install the special tool.
2. Install a new retaining ring.



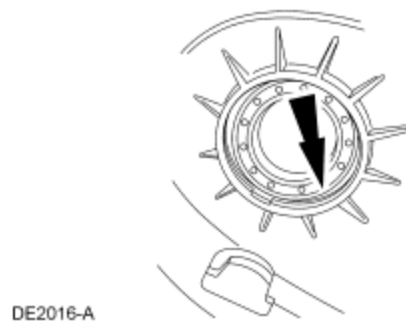
16. Using the special tools, install a new input seal.



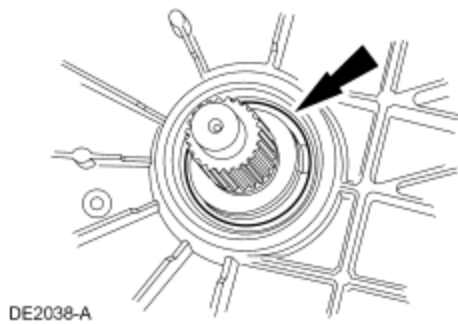
17. Using the special tools and a suitable press, install a new front output ball bearing.



18. Install a new front output ball bearing retaining ring.

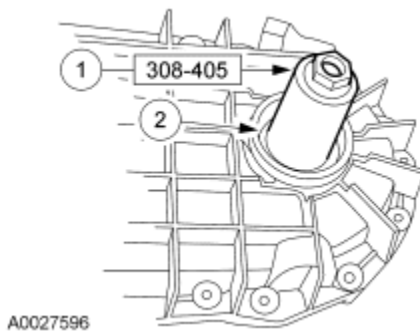


19. Position the front output shaft in the front case.

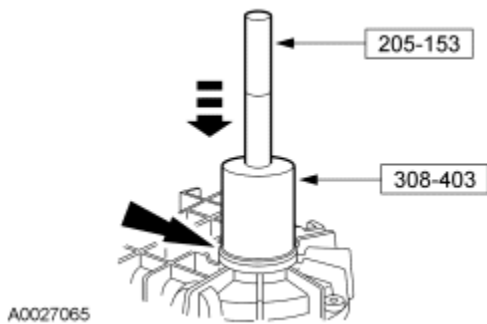


20. Install a new retaining ring.

1. Install the special tool.
 2. Install a new retaining ring.
- Remove the special tool.

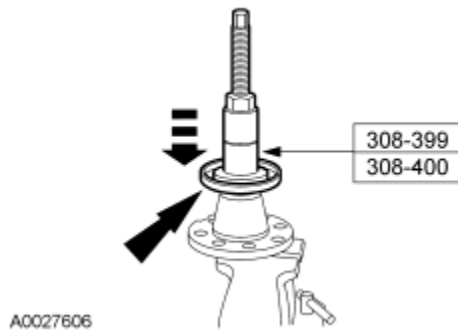


21. Using the special tools, install a new front output seal.



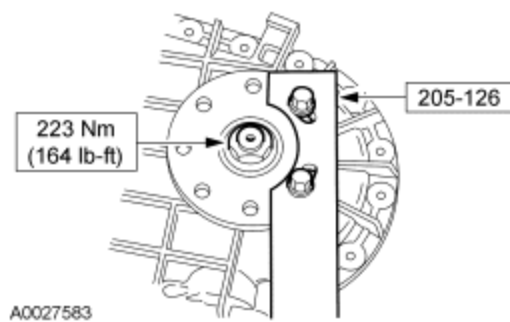
22. Install a new slinger if previously removed.

- Using the special tools, install a new slinger on the front flange.



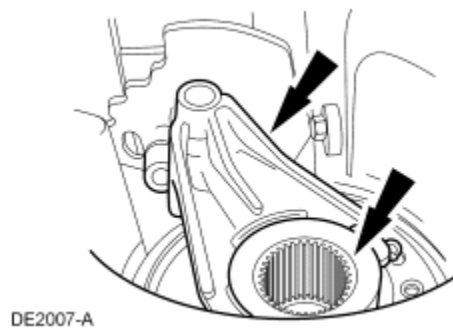
23. Install the front flange.

- While using the special tool to prevent the flange from turning, install a new nut.

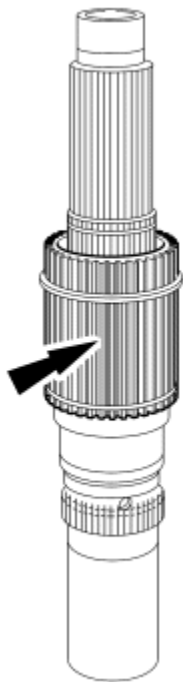


24. **NOTE:** Rotate the sector assembly to the 4-wheel high position for easy installation.

Position the range fork assembly and range shift sleeve in the front case.

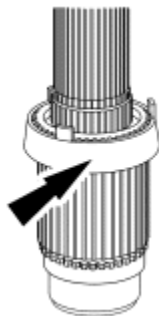


25. Position the drive sprocket hub onto the mainshaft.



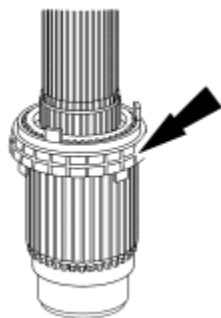
DE2014-A

26. On the electric shift transfer case mainshaft, position the inner ring onto the drive sprocket.



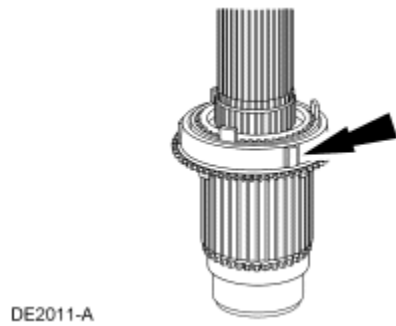
DE2013-A

27. On the electric shift transfer case mainshaft, position the middle ring onto the inner ring.

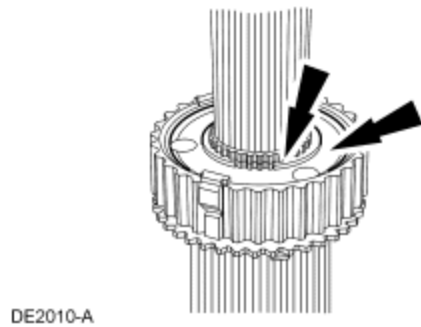


DE2012-A

28. On the electric shift transfer case mainshaft, position the outer ring onto the middle ring.

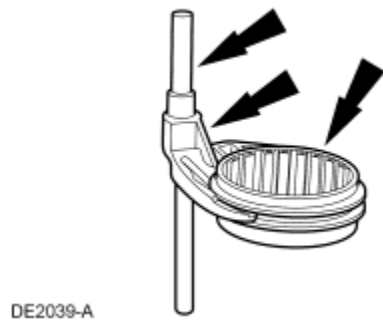


29. Position and rotate the synchronizer hub until it drops into the installed position. Install a new retaining ring.

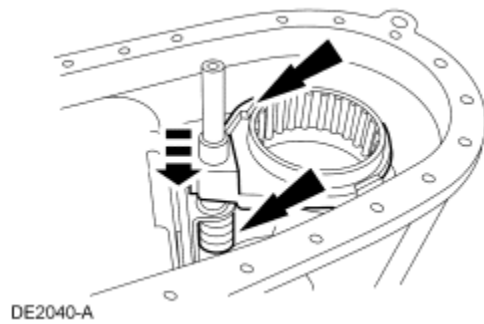


30. **NOTE:** The thin side of the synchronizer sleeve must face upward.

Assemble the mode fork, the shift rail and the synchronizer sleeve.

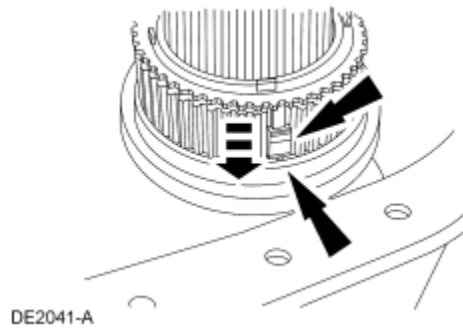


31. Install the mode fork and shift rail assembly into the front case.
- Make sure to bottom the shift rail in the case.

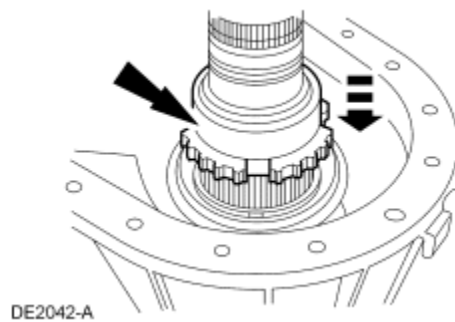


32. **⚠ CAUTION:** Install the mainshaft assembly so that the synchronizer strut bears against one of the synchronizer sleeve teeth.

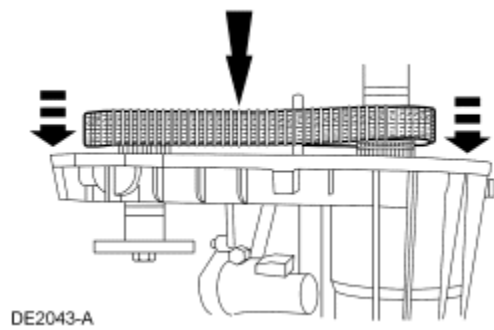
Install the mainshaft.



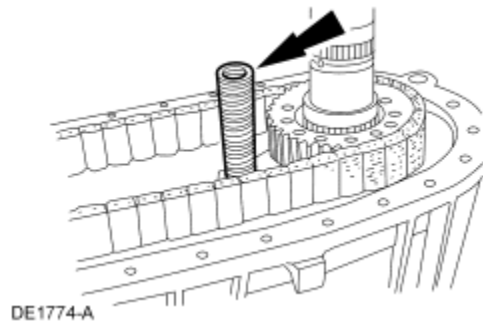
33. Install the clutch gear.



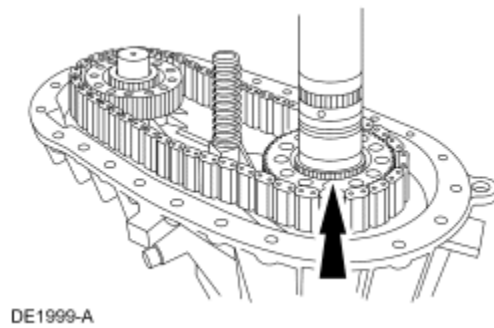
34. Install the drive sprocket, the driven sprocket and the drive chain as an assembly.



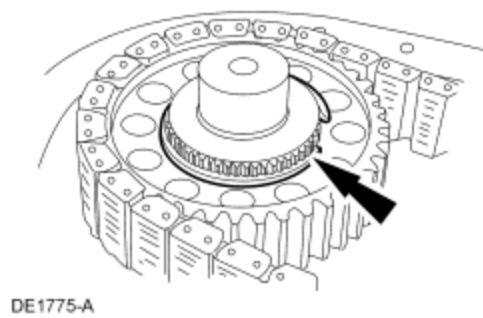
35. Install the mode spring.



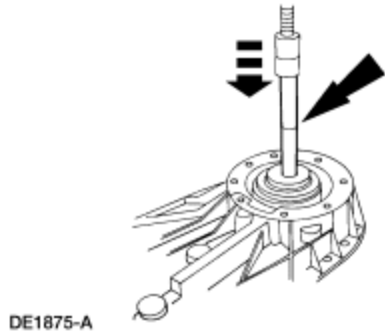
36. Install a new drive sprocket retaining ring.



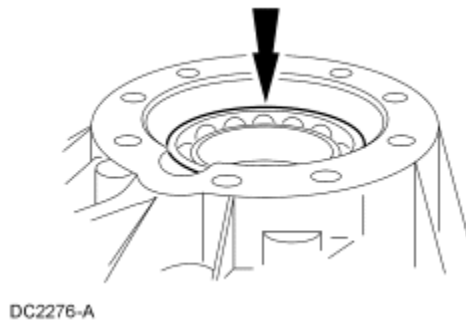
37. Install a new driven sprocket retaining ring.



38. Using the Rear Output Bearing Installer, the Handle and a suitable press, install a new ball bearing.

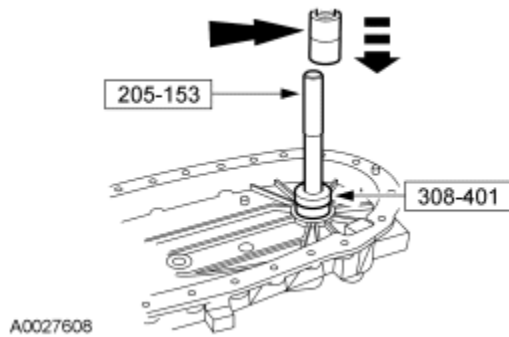


39. Install a new ball bearing retaining ring.

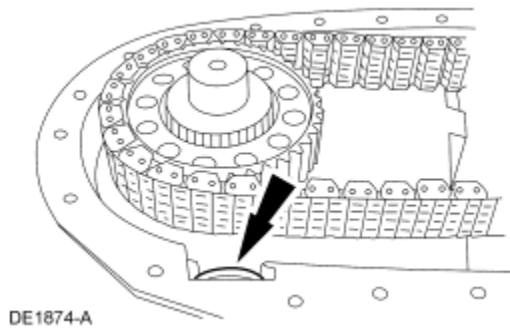


40. **NOTE:** The identification numbers must face the driver while installing.

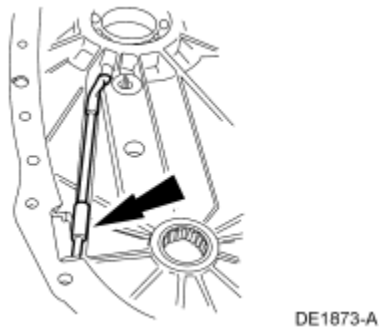
Using the special tools and a suitable press, install a new needle bearing.



41. Install the chip collector magnet.



42. Install the oil tube.



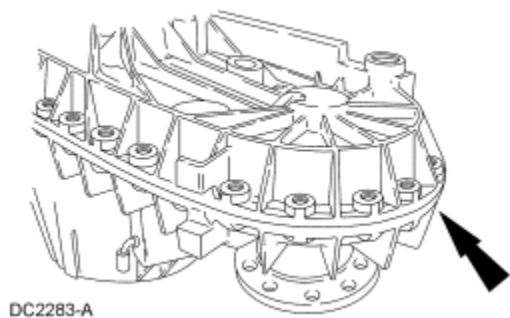
43. Clean both case mating surfaces with metal surface cleaner.

44. **NOTE:** The silicone bead must be no larger than 2 mm (0.08 in) in diameter.

Apply a bead of silicone gasket and sealant to the joint face of the case.

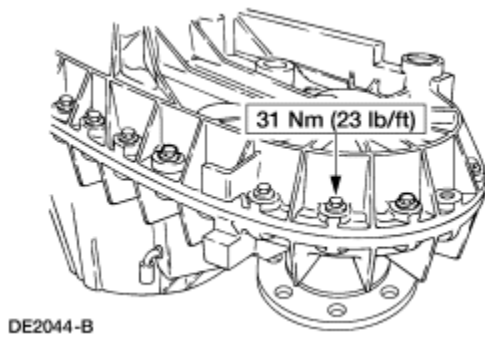
- The bead must be on the inside of the bolt holes, toward the inside of the case.

45. Position the rear case half onto the front case half.

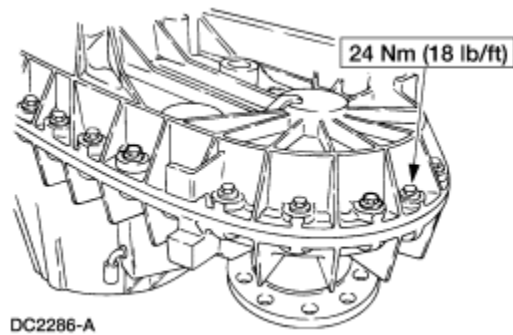


46. **NOTE:** Use a crisscross pattern when tightening the case bolts.

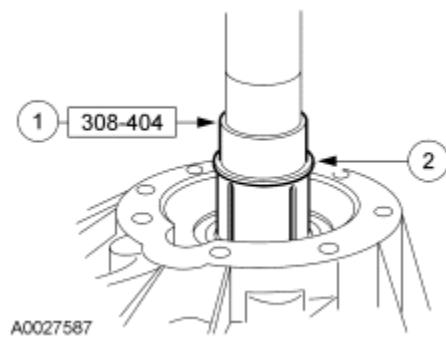
Install and tighten the 25 new case bolts.



47. Install the two new dowel bolts at each end of the case.

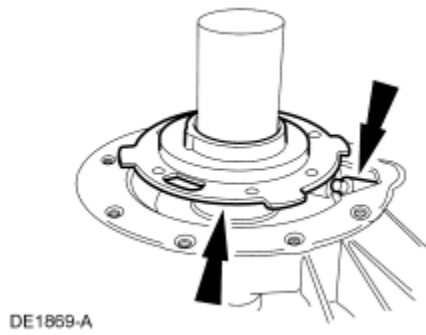


48. Install the new retaining ring.
1. Install the special tool.
 2. Install the new retaining ring.



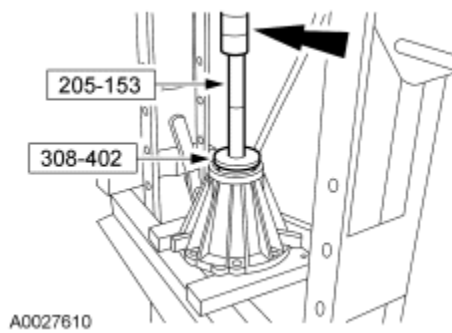
49. **NOTE:** Prior to assembly, make sure the O-ring is in the oil pump pickup inlet.

Slide the oil pump assembly onto the mainshaft and connect the oil tube.



50. **NOTE:** The identification numbers must face the driver while installing.

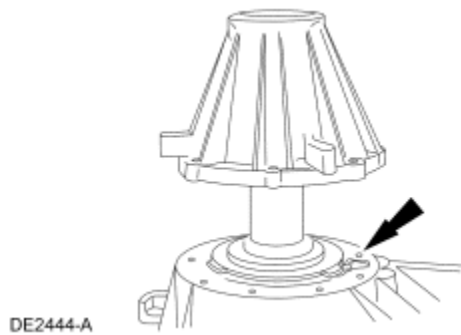
Using the special tools and a suitable press, install a new needle bearing.



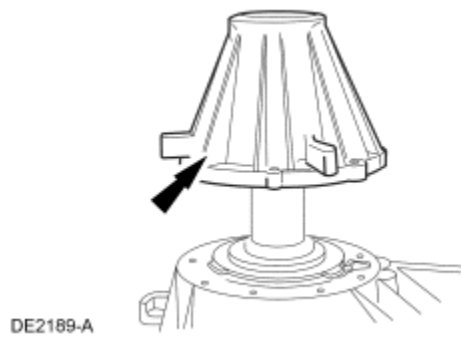
51. Clean the case and rear retainer mating surfaces with metal surface cleaner.

52. Apply a bead of silicone gasket and sealant to the rear retainer joint face.

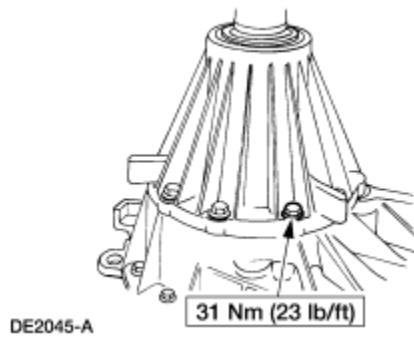
- The bead must be on the inside of all but one of the bolt holes.



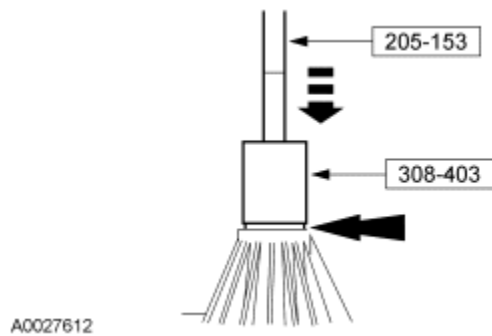
53. Position the rear retainer onto the rear case.



54. Install the eight new retaining bolts.

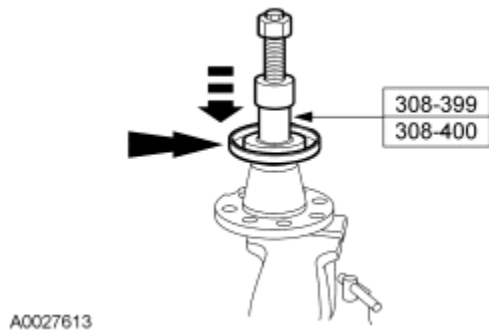


55. Using the special tool, install a new rear output seal.



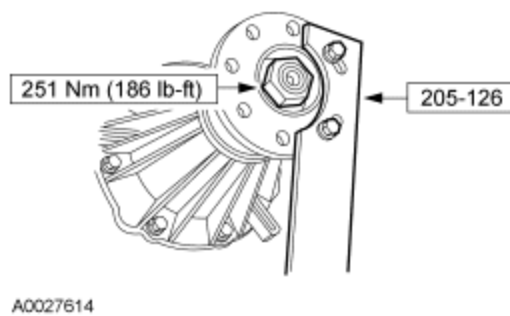
56. **NOTE:** Install a new slinger if previously removed.

Using the special tools, install a new slinger.



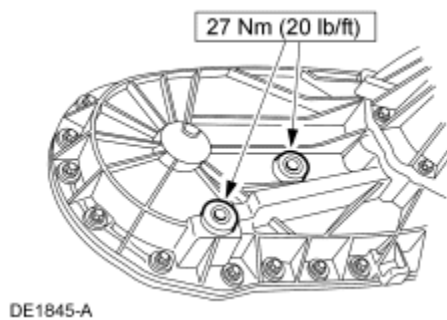
57. Install the rear flange.

- While using the special tool to prevent the flange from turning, install a new nut.



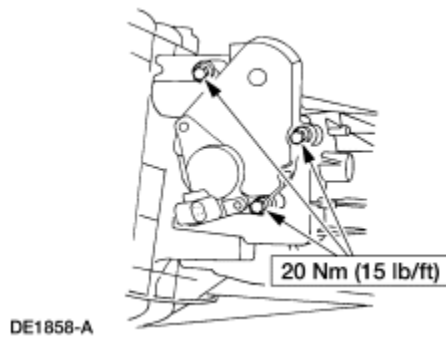
58. **⚠ CAUTION: Do not use air tools.**

Install the drain and fill plugs.

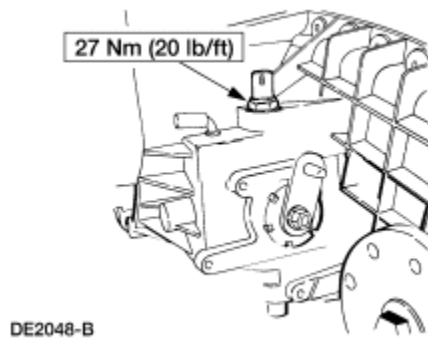


59. **NOTE:** Apply a coat of multi-purpose grease to the motor adapter.

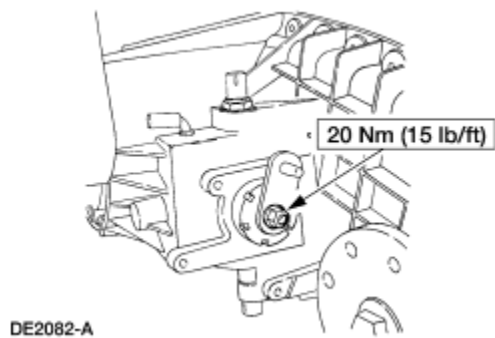
On the electric shift transfer case, install the gear motor encoder assembly.



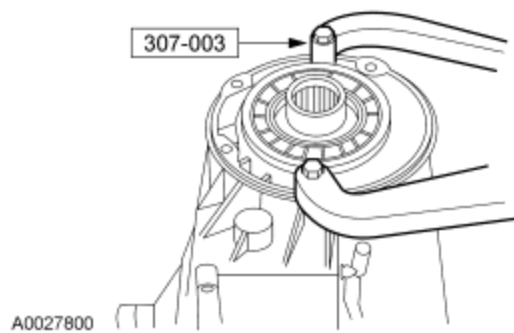
60. On the manual shift transfer case, install the 3-position switch.



61. Tighten the lever nut.



62. Remove the transfer case from the special tool.



Transfer Case

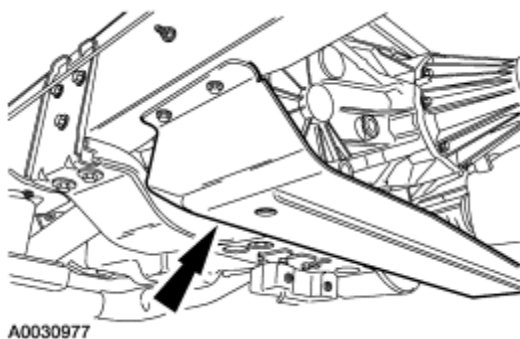
Material	
Item	Specification
Metal Surface Cleaner F4AZ-19A536-RA	WSE-M5B392-A

All vehicles

1. **NOTE:** Shift the transfer case to 2W HI.

Raise and support the vehicle. For additional information, refer to [Section 100-02](#).

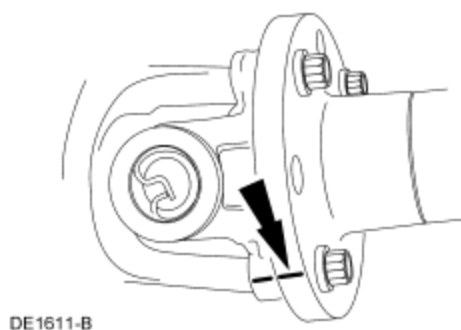
2. Remove the four bolts and the skid plate, if equipped.



3. **NOTE:** Index-mark the driveshaft to maintain driveline balance.

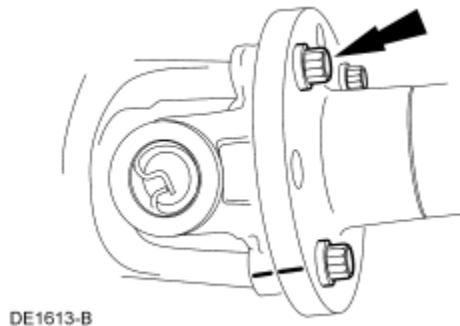
Remove the rear driveshaft. For additional information, refer to [Section 205-01](#).

4. Index-mark the front driveshaft to the transfer case flange.



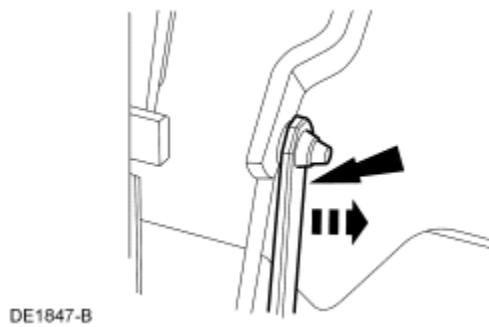
5. **NOTE:** Support the front driveshaft with wire or a strap.

Remove and discard the four bolts and position the front driveshaft aside.

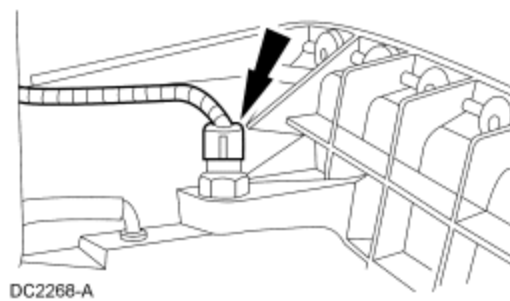


Manual shift transfer case

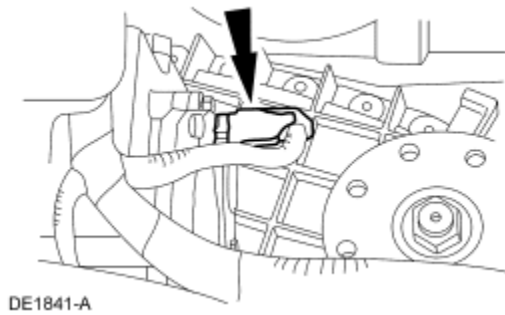
6. Remove the manual shift linkage, if equipped.



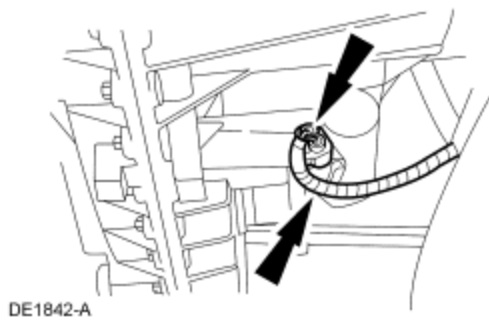
7. Disconnect the switch electrical connector. Position the wire harness aside.



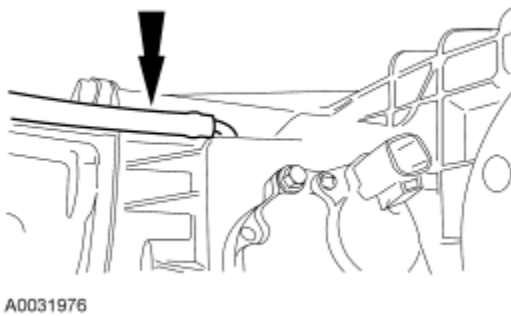
Electric shift transfer case



8. Disconnect the gear motor encoder assembly electrical connector and the gear motor electrical connector. Position the wire harness aside.

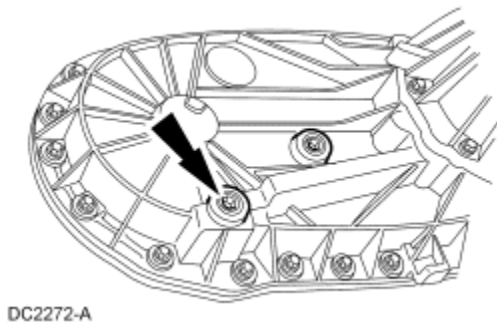


9. Disconnect the transfer case vent hose.

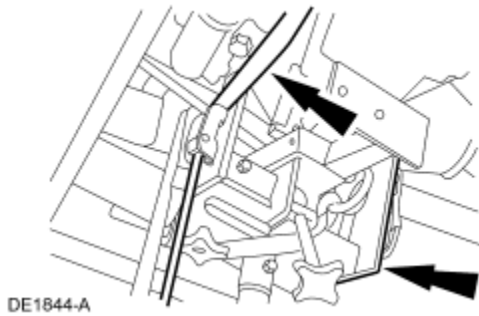


All transfer cases

10. If disassembly is necessary, drain the fluid into a suitable container.
 - Install the plug when finished.

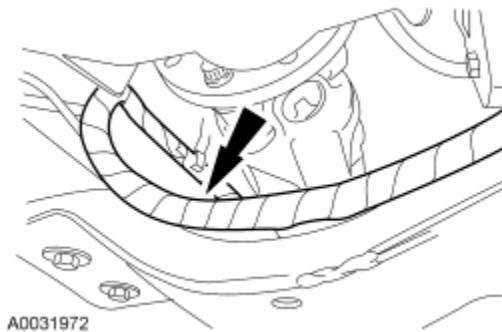


11. Position a suitable high-lift jack under the transfer case and secure it with safety straps.

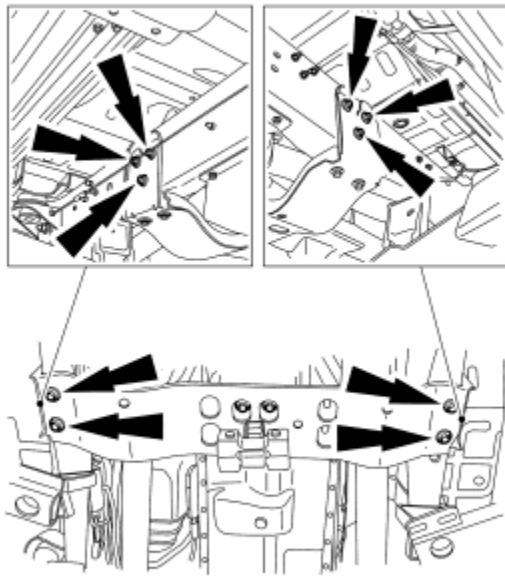


Excursion vehicles

12. Detach the wire harness from the crossmember.



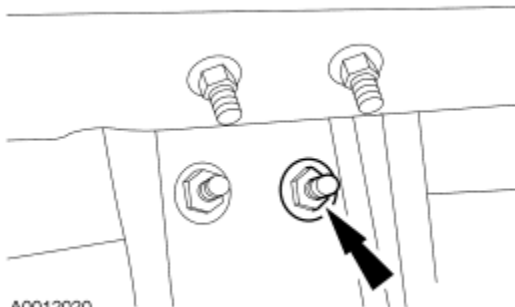
13. Remove the ten crossmember-to-frame bolts.



A0031974

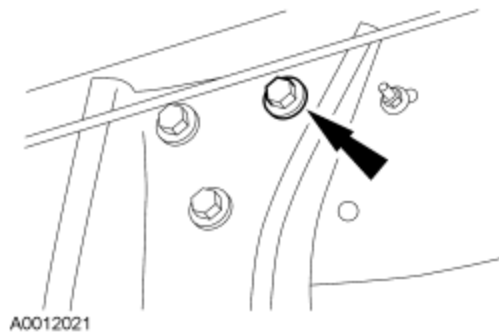
F-Super Duty automatic transmission vehicles

14. Remove the four RH crossmember bolts.



A0012020

15. Remove the three LH crossmember bolts.

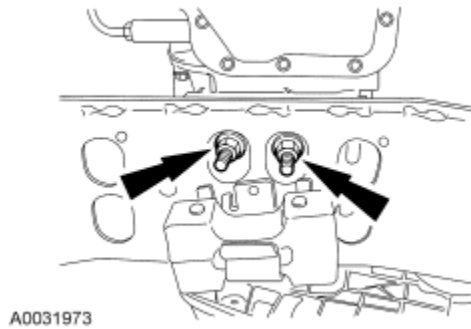


A0012021

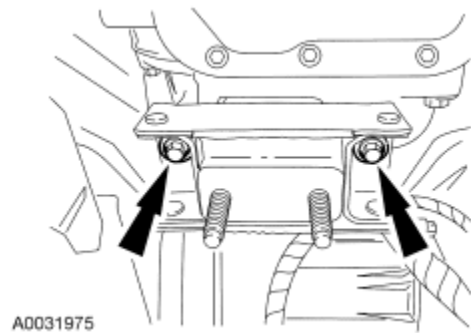
All vehicles equipped with automatic transmissions

16. **NOTE:** Typical is shown.

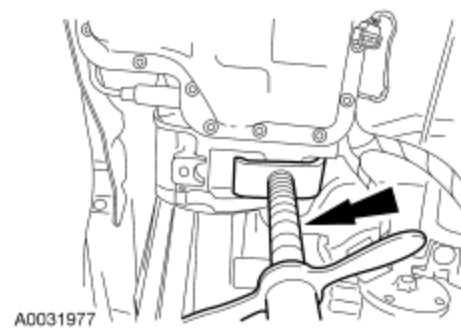
Remove the nuts and the crossmember.



17. Remove the transmission mount.

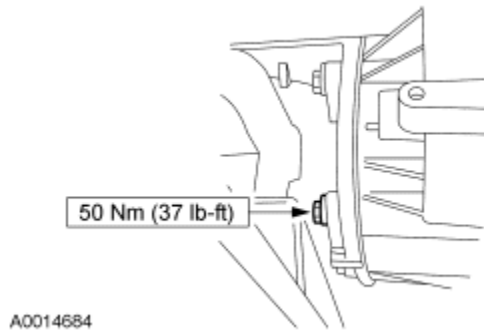


18. Position a suitable jack stand under the extension housing.



All vehicles

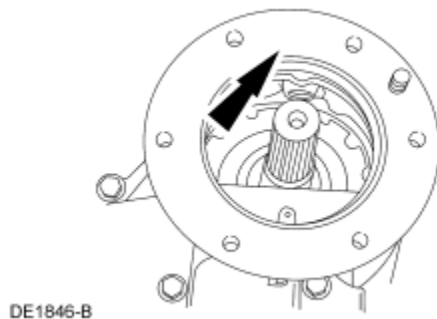
19. Remove the six transfer case-to-transmission bolts.



20. Separate the transfer case from the extension housing. Pull the transfer case rearward, then lower the transfer case from the vehicle.

21.  **CAUTION: Carefully clean the gasket surfaces. Nicks and gouges cause fluid leaks.**

Remove the transfer case-to-transmission gasket. Clean the mating surfaces, using metal surface cleaner.



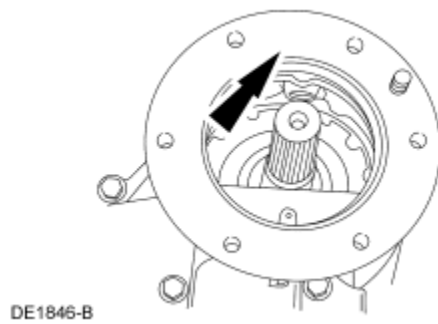
SECTION 308-07B: Transfer Case INSTALLATION


1999 F-Super Duty 250-550 Workshop Manual
[Procedure revision date: 01/30/2002](#)

Transfer Case

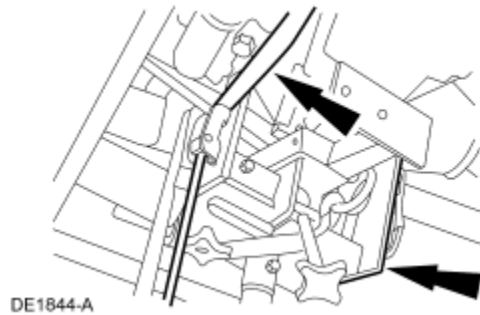
All vehicles

1. Install a new mounting gasket.

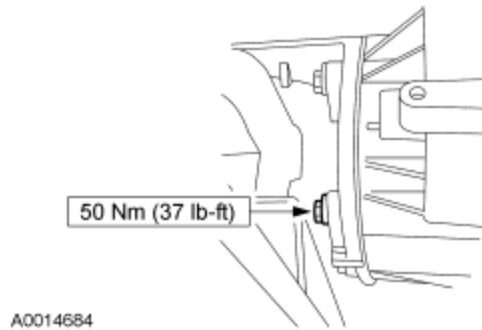


2.  **CAUTION:** Secure the transfer case to the high-lift jack with a safety strap.

Raise the transfer case into position.

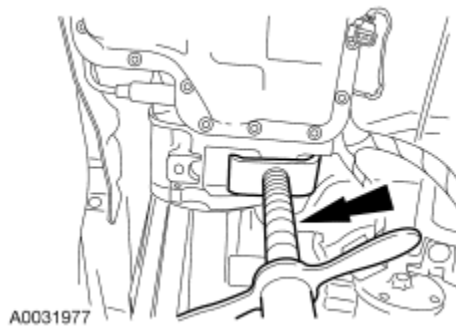


3. Install the six bolts retaining the transfer case to the extension housing.

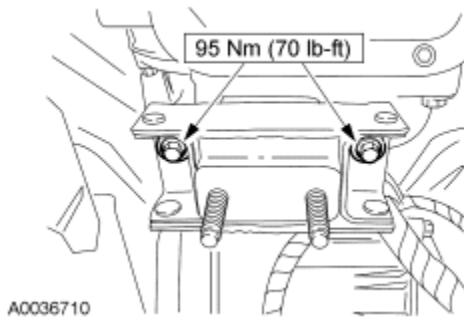


Automatic transmission vehicles

4. Remove the jack stand from the extension housing.

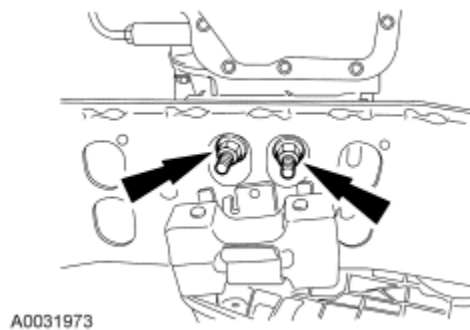


5. Install the transmission mount.



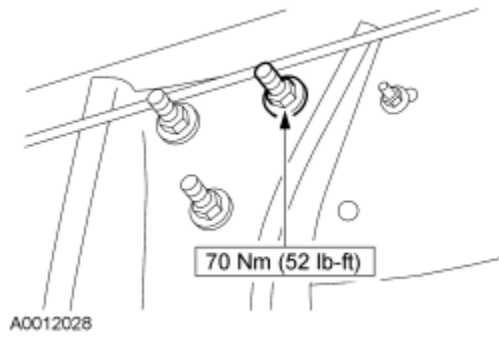
6. **NOTE:** Typical is shown.

Position the crossmember and loosely install the two nuts.

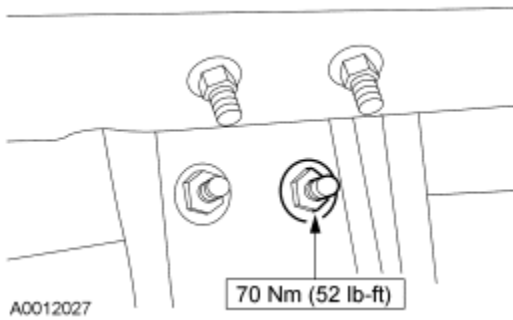


F-Super Duty automatic transmission vehicles

7. Install the three LH crossmember bolts.

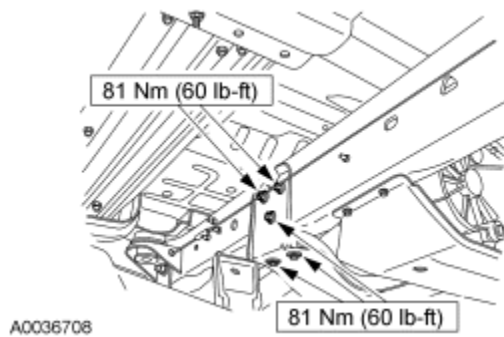
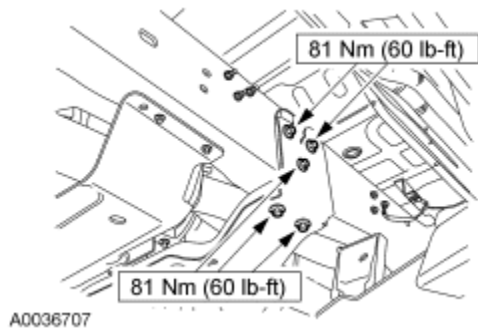


8. Install the RH crossmember bolts.

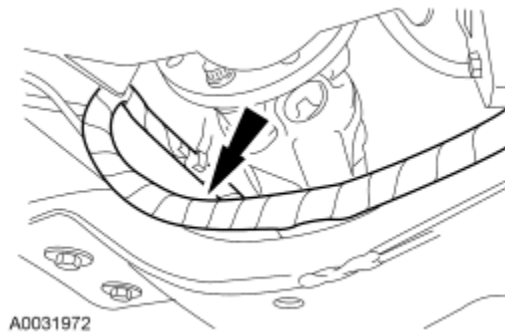


Excursion automatic transmission vehicles

9. Install the ten crossmember bolts.

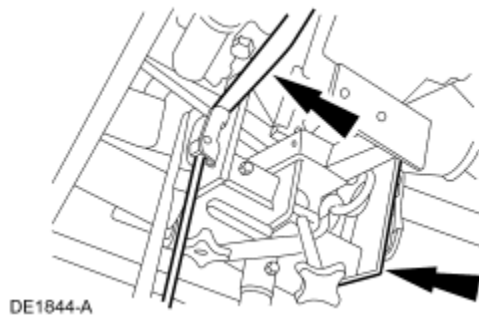


10. Attach the wire harness to the crossmember.



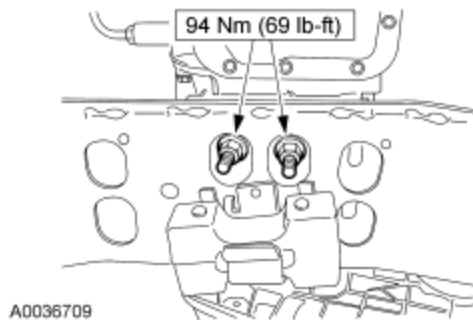
All vehicles

11. Remove the high-lift jack.



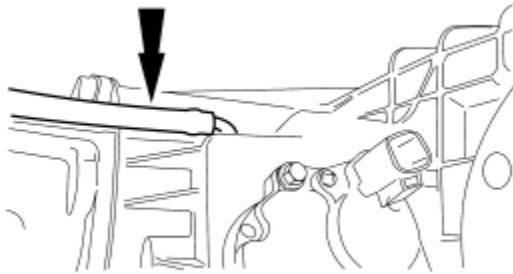
Automatic transmission vehicles

12. Tighten the transmission mount-to-crossmember nuts.



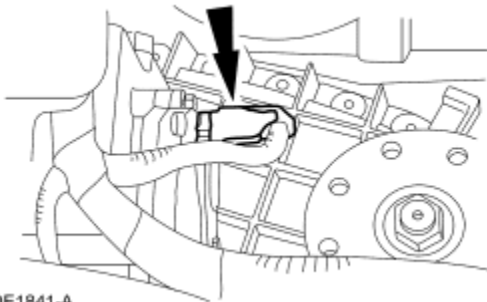
All electric shift transfer cases

13. Connect the vent hose.

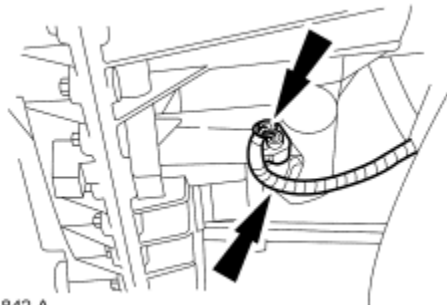


A0031976

14. Connect the two gear motor encoder assembly electrical connectors.



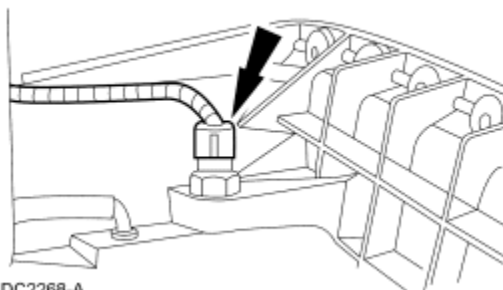
DE1841-A



DE1842-A

All manual shift transfer cases

15. Connect the 3-position mode switch harness connector.



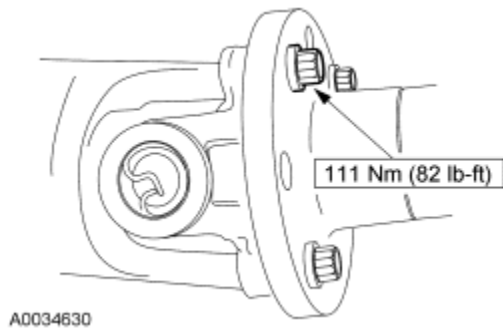
DC2268-A

16. Connect the manual shift linkage.

All vehicles

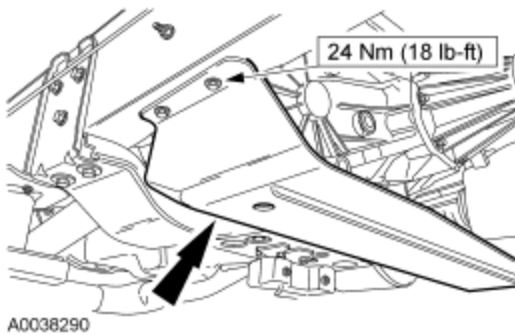
17.  **CAUTION: Align the index-marks when installing the driveshaft.**

Connect the front driveshaft to the transfer case and install the four new bolts.



18. Install the rear driveshaft. For additional information, refer to [Section 205-01](#).

19. If equipped, install the skid plate and the four bolts.



20. If drained, fill the transfer case. For additional information, refer to [Transfer Case Draining and Filling](#) in this section.
-

GROUP 09: Exhaust System

[SECTION 309-00: Exhaust System — General Information](#)

SECTION 309-00: Exhaust System — General Information

[SPECIFICATIONS](#)

DESCRIPTION AND OPERATION

[Exhaust System](#)

DIAGNOSIS AND TESTING

[Exhaust System](#)

[Inspection and Verification](#)

[Symptom Chart](#)

[Pinpoint Tests](#)

REMOVAL AND INSTALLATION

[Muffler and Tailpipe—5.4L and 6.8L](#)

[Muffler and Tailpipe—7.3L Diesel](#)

[Muffler Inlet Pipe—5.4L and 6.8L](#)

[Muffler Inlet Pipe—7.3L Diesel](#)

[Three Way Catalytic Converters \(TWC\)—5.4L](#)

[Three Way Catalytic Converter \(TWC\)—6.8L](#)

[Heat Shield—Catalytic Converter and Muffler](#)

SECTION 309-00: Exhaust System — General
Information

1999 F-Super Duty 250-550 Workshop
Manual

SPECIFICATIONS

[Procedure revision date: 01/26/2000](#)

Torque Specifications		
Description	Nm	Lb/Ft

Heat Shield Screws	13-17	—
Muffler Inlet Pipe	34-46	25-33
Muffler Inlet Pipe-to-Exhaust Manifold Nuts	40-50	30-36
Muffler Inlet Pipe-to-Intermediate Pipe Flange Nuts—7.3L Diesel	40	30
Muffler-to-Catalytic Converter Clamp Nuts	47-63	35-46
Turbo-to-Muffler Inlet Pipe Clamp Nut	26-34	16-25
Muffler Inlet Pipe to TWC Clamp Nuts	40-55	30-40
Muffler to Catalytic Converter Pipe Clamp Nuts	40-55	30-40

SECTION 309-00: Exhaust System — General Information
DESCRIPTION AND OPERATION

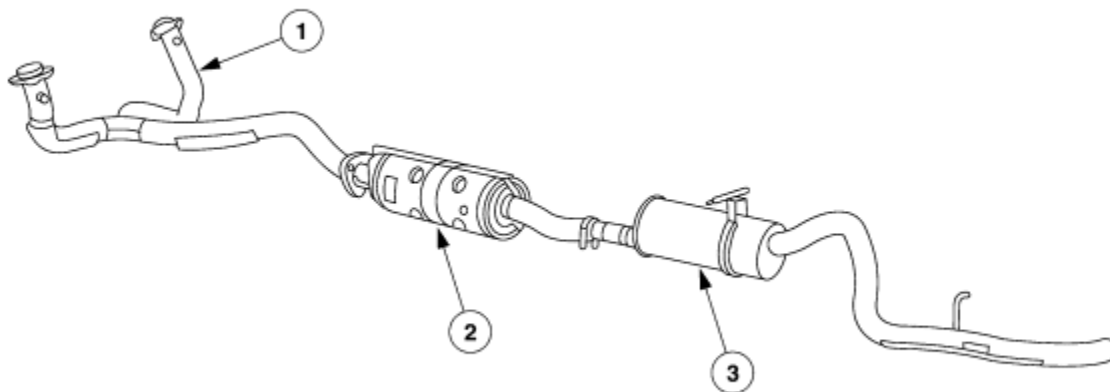
1999 F-Super Duty 250-550 Workshop Manual
[Procedure revision date: 01/26/2000](#)

Exhaust System

The exhaust system:

- is constructed of stainless steel.
- contains dual three way catalytic converters (TWC).
- has two upstream heated oxygen sensors (HO2S) mounted before the TWCs.

Component Location—5.4L and 6.8L Engines

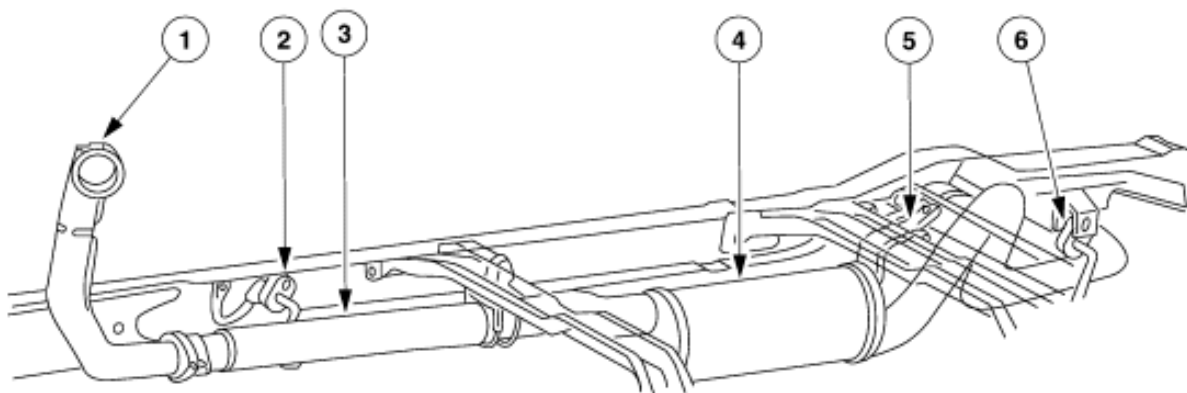


AU0148-A

Item	Part Number	Description
------	-------------	-------------

1	5242	Inlet Y-Pipe
2	5E212	Three Way Catalytic Converter
3	5K214	Muffler and Tailpipe Assembly

Component Location—7.3L Engine



AU0104-D

Item	Part Number	Description
1	6N646	Exhaust Inlet Pipe
2	5A246	Exhaust Hanger Insulator
3	—	Intermediate Pipe
4	5230	Muffler
5	5A242	Exhaust Hanger Insulator
6	5260	Exhaust Hanger Insulator

SECTION 309-00: Exhaust System — General
Information
DIAGNOSIS AND TESTING

1999 F-Super Duty 250-550 Workshop
Manual
[Procedure revision date: 01/26/2000](#)

Exhaust System

Inspection and Verification

1. Verify the customer's concern by running the engine or road testing the vehicle to duplicate the condition.
2. Visually inspect the components of the exhaust system and related controls that may affect exhaust gas quality or cause backfire or loss of power.
3. Visually inspect for obvious signs of mechanical and electrical damage; refer to the following chart.

Visual Inspection Chart	
Mechanical	Electrical
<ul style="list-style-type: none"> • Leaking fuel injectors. • Damaged intake air passages. • Inoperative exhaust gas recirculation (EGR) valve. • Exhaust pipe pinched, crushed. • Damaged, loose vacuum hoses. • Incorrect idle speed. • Dirty engine air cleaner element. • Damaged catalytic converter. 	<ul style="list-style-type: none"> • Misrouted, damaged wiring. • Damaged ignition coil, distributor or spark plugs. • Damaged, loose connectors.

4. Exercise the wiring and connectors for the solenoids and other components for obvious problems due to looseness, corrosion, or other damage. This must be done while the engine is fully warmed and the system controls are activated.
5. Check the vacuum lines and connections for looseness, pinching, leakage, splitting, blockage, or other damage.
6. If a vacuum line or orifice (restrictor) blockage is suspected, correct the cause before proceeding to the next step.
7. If the fault is not visually evident, determine the symptom and proceed to the Symptom Chart.


Symptom Chart

SYMPTOM CHART		
Condition	Possible Sources	Action
<ul style="list-style-type: none"> • Noisy or Leaking Exhaust 	<ul style="list-style-type: none"> • Exhaust leak. • Misaligned exhaust. • Loose clamps. 	<ul style="list-style-type: none"> • GO to Pinpoint Test A.

	<ul style="list-style-type: none"> Restricted exhaust. 	
<ul style="list-style-type: none"> Loss of Power 	<ul style="list-style-type: none"> Kinked or damaged exhaust pipe. Clogged catalytic converter. Foreign object in exhaust pipe. 	<ul style="list-style-type: none"> GO to Pinpoint Test B.



Pinpoint Tests




PINPOINT TEST A: NOISY OR LEAKING EXHAUST


CONDITIONS	DETAILS/RESULTS/ACTIONS
A1 CHECK THE CLAMPS AND BRACKETS	
<div>1</div> 	
	<div>2</div> Inspect the exhaust system for loose or broken clamps and brackets.
	<ul style="list-style-type: none"> Are the clamps and brackets OK? <p>→ Yes GO to A2.</p> <p>→ No TIGHTEN or REPLACE the damaged clamps or brackets. TEST the system for normal operation.</p>
A2 CHECK THE EXHAUST COMPONENTS	
	<div>1</div> Inspect the exhaust components for punctures, split seams, or improper welds.
	<ul style="list-style-type: none"> Are the exhaust components OK? <p>→ Yes GO to A3.</p>

	<p>→ No REPLACE the damaged exhaust components. TEST the system for normal operation.</p>
A3 CHECK THE EXHAUST MANIFOLD(S)	
	<p>1 Inspect the exhaust manifolds (9430) for loose fasteners or cracks.</p>
	<p>• Are the exhaust manifolds OK?</p> <p>→ Yes GO to Pinpoint Test B.</p> <p>→ No TIGHTEN loose fasteners or REPLACE the exhaust manifolds; REFER to Section 303-01A (5.4L), Section 303-01B (6.8L) or Section 303-01C (7.3L). TEST the system for normal operation.</p>

PINPOINT TEST B: LOSS OF POWER

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1 PERFORM A VACUUM TEST	
<p>1</p> 	
	<p>2 Perform the Intake Manifold Vacuum Test; refer to Section 303-00.</p>
	<p>• Is the vacuum within specification?</p> <p>→ Yes REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual, for diagnosis and testing of the engine.</p> <p>→ No GO to B2.</p>
B2 PERFORM A VACUUM TEST — EXHAUST DISCONNECTED	
<p>1</p> 	
	<p>2 Disconnect the exhaust system at the exhaust manifolds; refer to the Three</p>

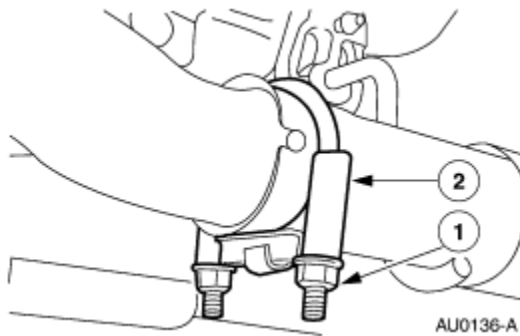
	Way Catalytic Converters (TWC)—5.4L or Three Way Catalytic Converter (TWC)—6.8L in this section.
<div>3</div> 	
	<div>4</div> Perform the Intake Manifold Vacuum Test; refer to Section 303-00 .
	<ul style="list-style-type: none"> Is the vacuum within specification? <p>→ Yes GO to B3.</p> <p>→ No GO to B4.</p>
B3 PERFORM A VACUUM TEST — MUFFLER DISCONNECTED	
<div>1</div> 	
	<div>2</div> Reconnect the exhaust system at the exhaust manifolds; refer to the Three Way Catalytic Converters (TWC)—5.4L or Three Way Catalytic Converter (TWC)—6.8L in this section.
	<div>3</div> Disconnect the muffler and tailpipe; refer to the Muffler and Tailpipe—5.4L and 6.8L or Muffler and Tailpipe—7.3L Diesel in this section.
<div>4</div> 	
	<div>5</div> Perform an Intake Manifold Vacuum Test; refer to Section 303-00 .
	<ul style="list-style-type: none"> Is the vacuum within specification? <p>→ Yes REPLACE the muffler and tailpipe; refer to the Muffler and Tailpipe—5.4L and 6.8L or Muffler and Tailpipe—7.3L Diesel in this section. TEST the system for normal operation.</p> <p>→ No REPLACE the three way catalytic converter; refer to the Three Way Catalytic Converters (TWC)—5.4L or Three Way Catalytic Converter (TWC)—6.8L in</p>

	this section. TEST the system for normal operation.
B4 CHECK THE EXHAUST MANIFOLD	
<div style="border: 1px solid black; padding: 2px; display: inline-block;">1</div> 	
	<div style="border: 1px solid black; padding: 2px; display: inline-block;">2</div> Reconnect the exhaust system at the muffler and tailpipe; refer to the Muffler and Tailpipe—5.4L and 6.8L or Muffler and Tailpipe—7.3L Diesel in this section.
	<div style="border: 1px solid black; padding: 2px; display: inline-block;">3</div> Remove the exhaust manifolds; refer to Section 303-01A (5.4L), Section 303-01B (6.8L) or Section 303-01C (7.3L).
	<div style="border: 1px solid black; padding: 2px; display: inline-block;">4</div> Inspect the ports for casting flash.
	<ul style="list-style-type: none"> • Is there casting flash present? <p>→ Yes REMOVE the casting flash or REPLACE the exhaust manifolds; refer to Section 303-01A (5.4L), Section 303-01B (6.8L) or Section 303-01C (7.3L). TEST the system for normal operation.</p> <p>→ No REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the engine.</p>

Muffler and Tailpipe—5.4L and 6.8L

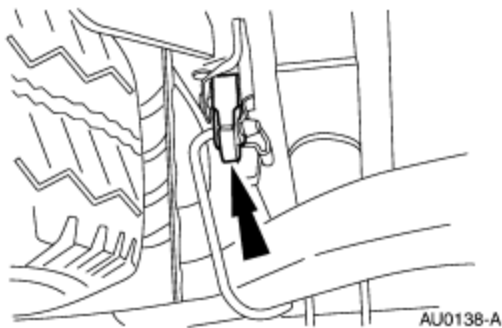
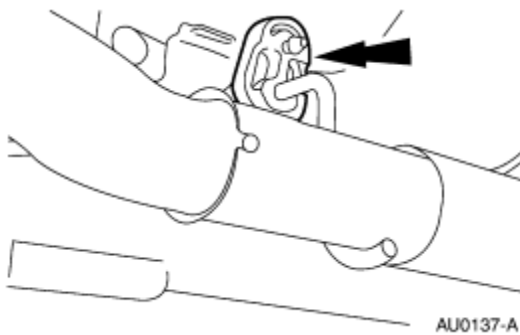
Removal

1. Raise and support the vehicle; refer to [Section 100-02](#).
2. Remove the muffler to three-way catalytic converter (TWC) pipe clamp.
 1. Remove the nuts.
 2. Remove the clamp.



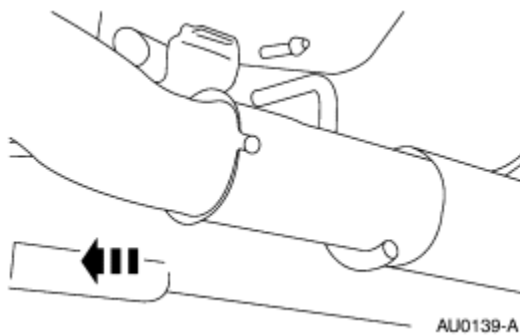
3. **NOTE:** The three tailpipe hanger insulators can be reused if they show no signs of damage.

Remove the tailpipe hanger insulators and discard if damaged.



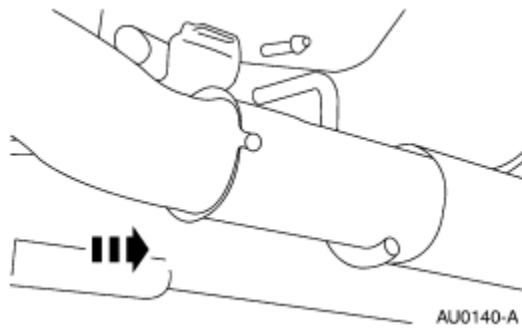
4. **NOTE:** It may be necessary to heat the joint to ease removal.

Remove the muffler and tailpipe assembly.



Installation

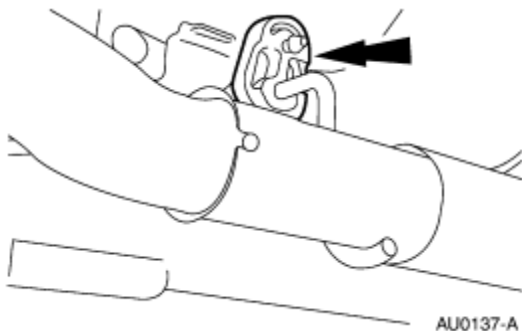
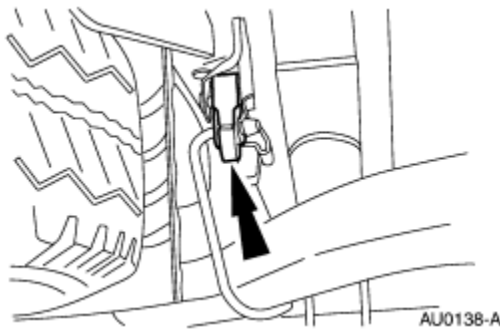
1. Position the muffler and tailpipe assembly.



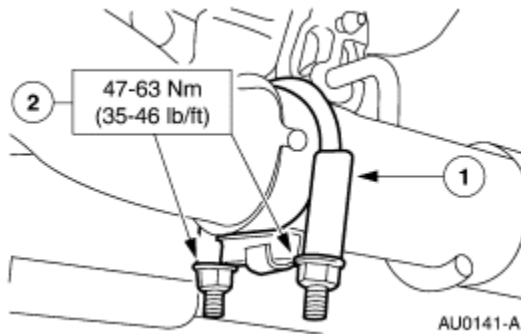
2.  **CAUTION: Do not use oil or grease-based lubricants on insulators which deteriorates the rubber.**

NOTE: A soap and water solution will ease installation of the muffler hangers into the rubber tailpipe hanger insulators.

Install the tailpipe hanger insulators.



3. Install the muffler to catalytic converter pipe clamp.
 1. Position the clamp.
 2. Install the nuts.



4. Lower the vehicle.

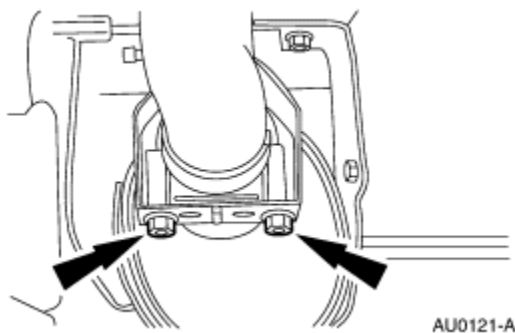
SECTION 309-00: Exhaust System — General
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REMOVAL AND INSTALLATION

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[Procedure revision date: 01/26/2000](#)

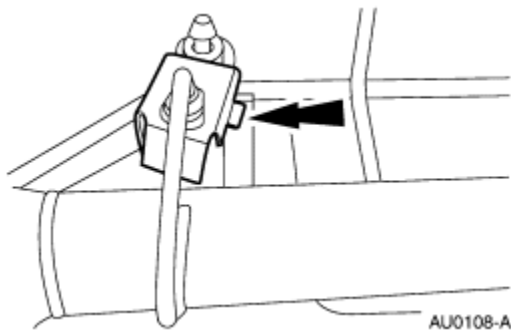
Muffler and Tailpipe—7.3L Diesel

Removal

1. Raise the vehicle on a hoist; refer to [Section 100-02](#).
2. Remove the clamp.



3. **NOTE:** It may be necessary to heat the muffler-to-intermediate joint to ease removal.
Separate the muffler from the intermediate pipe.
4. **NOTE:** The exhaust hanger insulators can be reused if they show no signs of damage.
Remove the exhaust hangers.



5. Remove the muffler and tailpipe.

Installation

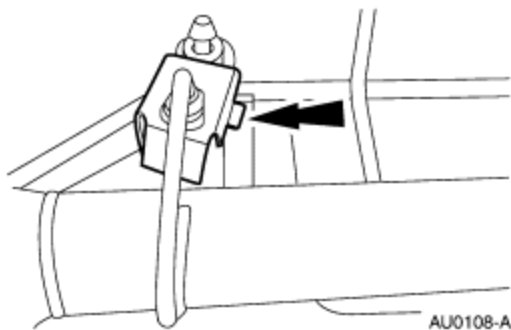
1. Position the muffler and tailpipe.



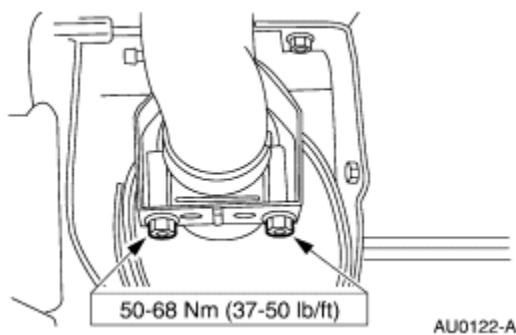
CAUTION: To prevent damage to the exhaust hanger insulators, do not lubricate with oil or grease-based lubricants.

2. **NOTE:** A soap and water solution will ease the installation of the exhaust insulator.

Install the exhaust hanger insulators.



3. Install the clamp.

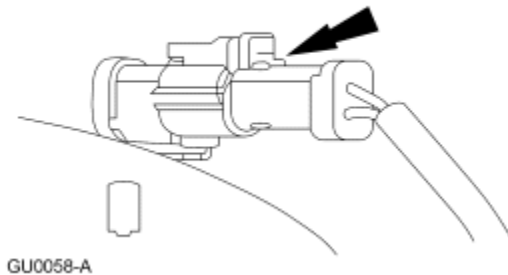


50-68 Nm (37-50 lb/ft)

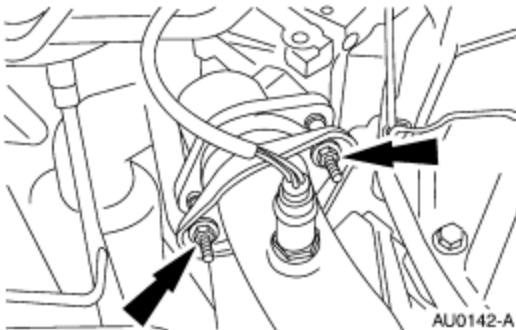
Muffler Inlet Pipe—5.4L and 6.8L

Removal

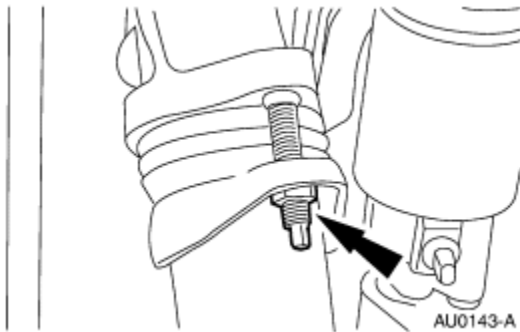
1. Raise the vehicle on a hoist; refer to [Section 100-02](#).
2. Disconnect the heated oxygen sensor electrical connections.



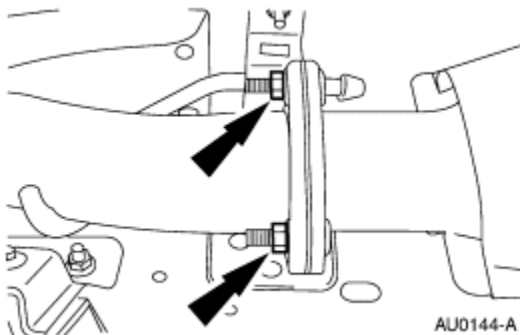
3. Remove the LH nuts.



4. Remove the RH nuts.



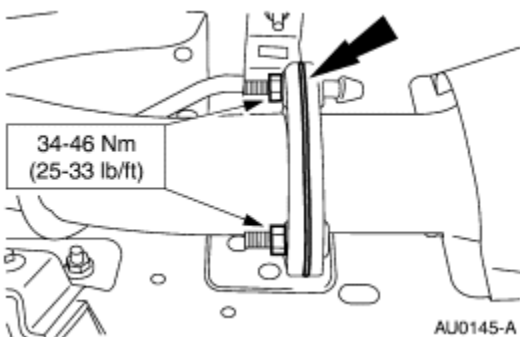
5. Remove the three nuts and discard the gasket.



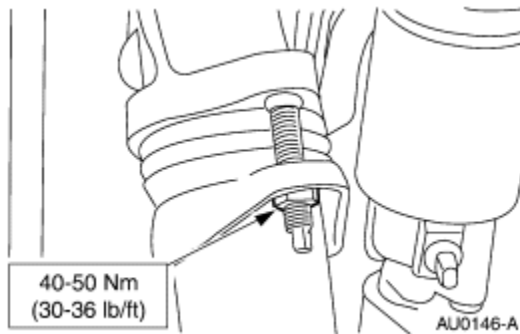
6. Remove the muffler inlet pipe.

Installation

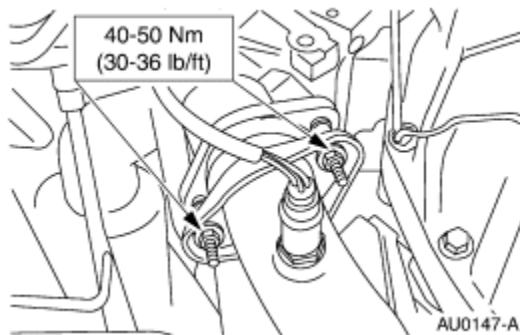
1. Position the muffler inlet pipe.
2. Install a new flange gasket and three nuts.



3. Install the two RH nuts.



4. Install the LH nuts.



5. Connect heated oxygen sensor electrical connections.
6. Lower the vehicle.

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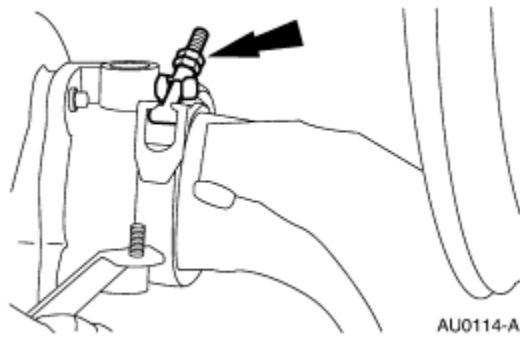
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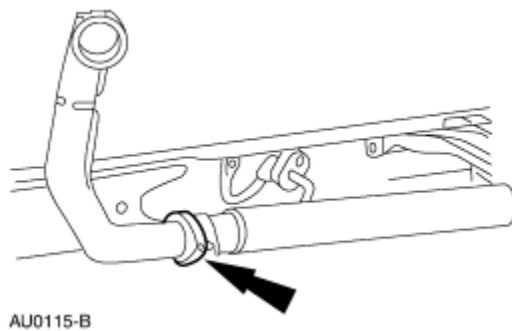
Muffler Inlet Pipe—7.3L Diesel

Removal

1. Remove the clamp.

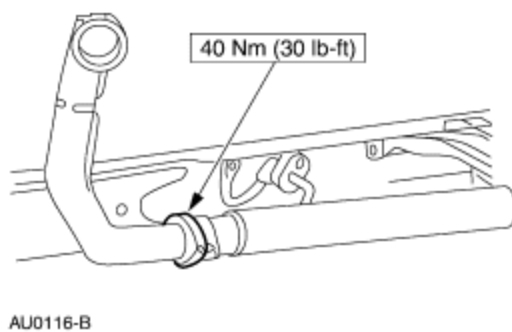


2. Raise the vehicle; refer to [Section 100-02](#).
3. Remove the nuts and discard the gasket.

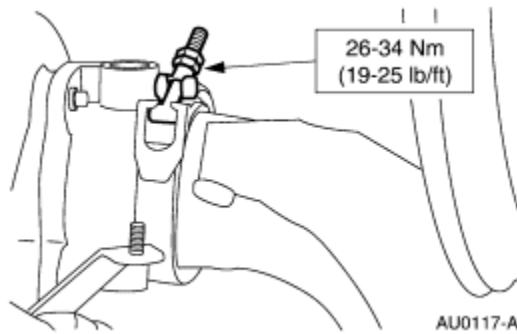


Installation

1. Position the muffler inlet pipe.
2. Install the nuts.



3. Lower the vehicle.
4. Install the clamp.



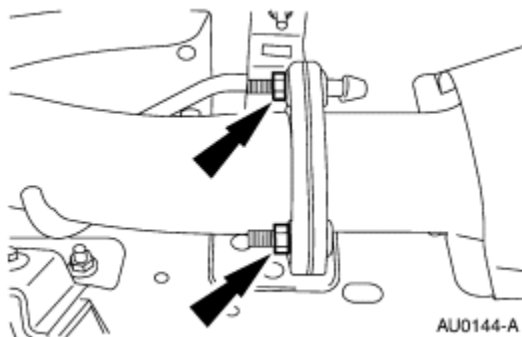
SECTION 309-00: Exhaust System — General
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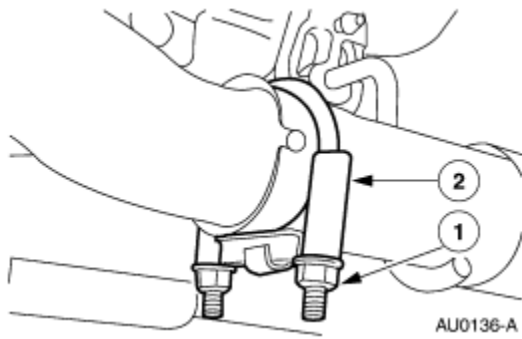
Three Way Catalytic Converters (TWC)—5.4L

Removal

1. Raise the vehicle on a hoist; refer to [Section 100-02](#).
2. Remove the three nuts.

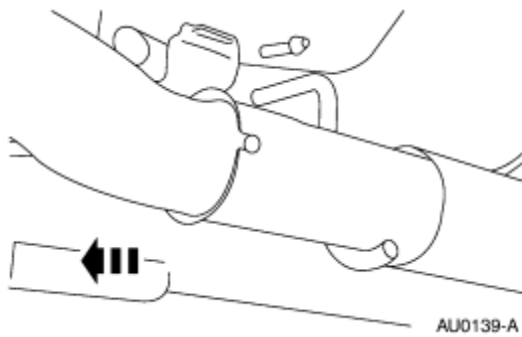


3. Remove the muffler-to-TWC clamp.
 1. Remove the nuts.
 2. Remove the clamp.



4. **NOTE:** It may be necessary to heat the joint to ease removal.

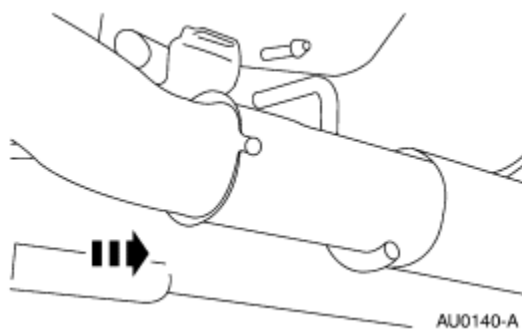
Separate the TWC from the muffler.



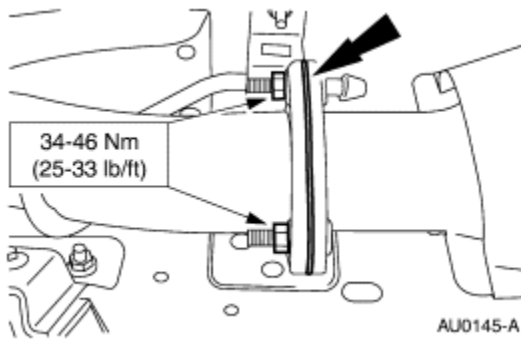
Installation

1. **NOTE:** It may be necessary to heat the joint to ease installation.

Insert the TWC into the muffler.

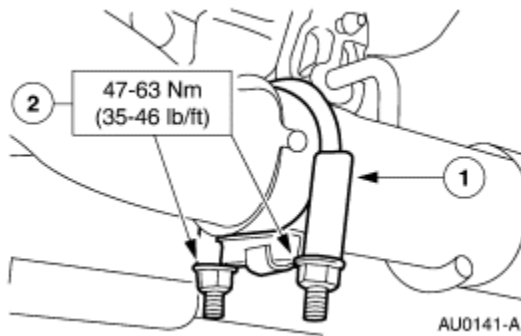


2. Install a new flange gasket and the three nuts.



3. Install the muffler to TWC clamp.

1. Position the clamp.
2. Install the nuts.



4. Lower the vehicle.

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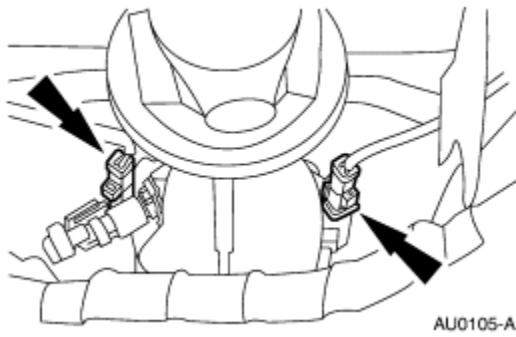
1999 F-Super Duty 250-550 Workshop
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[Procedure revision date: 01/26/2000](#)

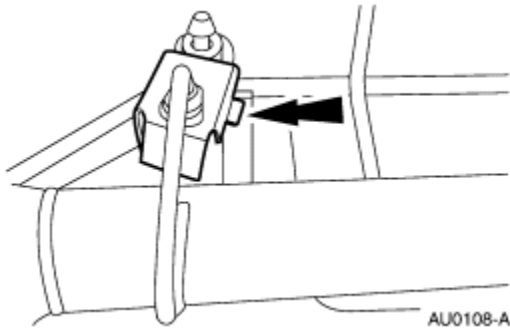
Three Way Catalytic Converter (TWC)—6.8L

Removal

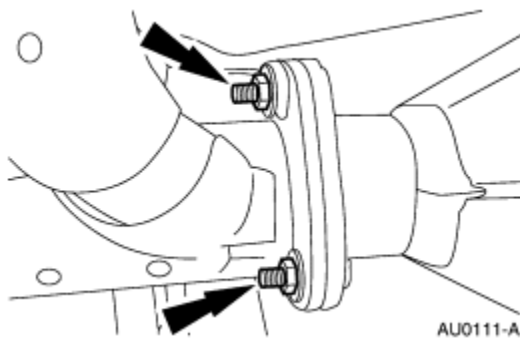
1. Raise the vehicle; refer to [Section 100-02](#).
2. Disconnect the catalytic monitor sensor electrical connector.



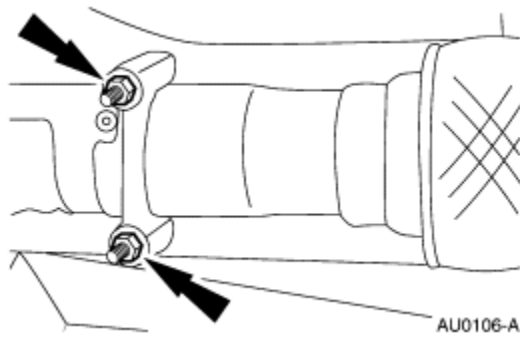
3. Support the exhaust system.



4. **NOTE:** The exhaust hanger insulators can be reused if they show no signs of damage.
Remove the exhaust hanger insulators and discard if damaged.
5. Remove the three nuts and the exhaust hanger bracket and gasket. Discard the gaskets.

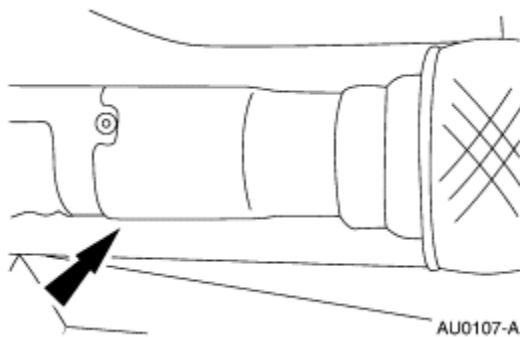


6. Remove the TWC-to-muffler clamp and exhaust hanger.



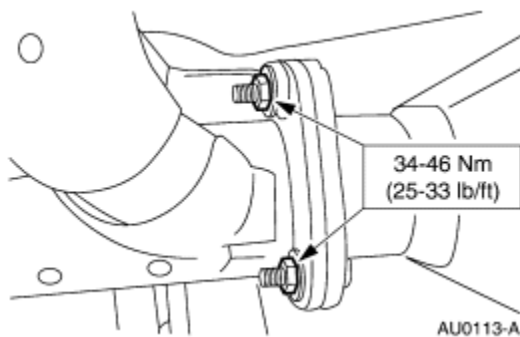
7. **NOTE:** It may be necessary to heat the TWC-to-muffler joint to ease removal.

Separate the three way catalytic converter (TWC) (5E212) from the muffler (5230).

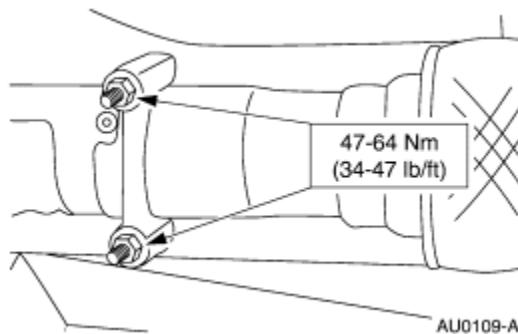


Installation

1. Position the three way catalytic converter and a new gasket.
2. Install the exhaust hanger bracket and the three nuts.



3. Install the TWC-to-muffler clamp and hanger.



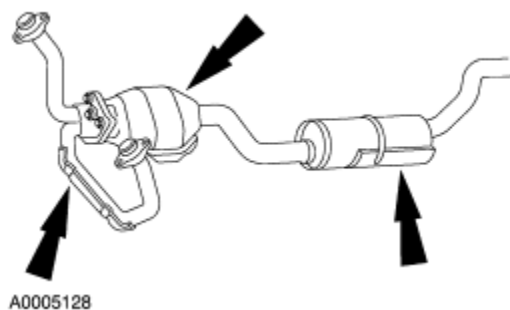
4. Connect the catalytic monitor sensor electrical connector.

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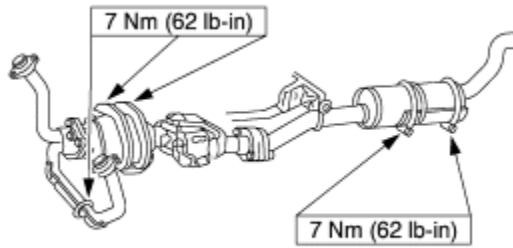
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Heat Shield—Catalytic Converter and Muffler

1. Disconnect the battery cable. For additional information, refer to [Section 414-01](#).
2. Raise the vehicle. For additional information, refer to [Section 100-02](#).
3. Inspect the catalytic converter and muffler for loose or missing heat shields.



4. Install worm clamps for heat shields that are loose.
 - Use one of the following clamps: FOTZ-5A231-A or W705949-S300.
 - Trim off the excess ear of the worm clamp.



A0005129

5. If the heat shields are missing, install new heat shields. If new heat shields are not available, install a new catalytic converter. For additional information, refer to [Three Way Catalytic Converters \(TWC\)—5.4L](#) or [Three Way Catalytic Converter \(TWC\)—6.8L](#) in this section.
6. Lower the vehicle.
7. Reconnect the battery cable.

GROUP 10: Fuel System

[SECTION 310-00: Fuel System — General Information](#)

[SECTION 310-01: Fuel Tank and Lines](#)

[SECTION 310-02: Acceleration Control](#)

[SECTION 310-03: Vehicle Speed Control](#)

SECTION 310-00:
Fuel System — General Information

[SPECIFICATIONS](#)

DESCRIPTION AND OPERATION

[Fuel System—Gasoline Engines](#)

[Fuel System—Diesel Engines](#)

DIAGNOSIS AND TESTING

[Fuel System](#)

GENERAL PROCEDURES

[Pressure Relief](#)

[Draining—Midship Fuel Tank](#)

[Draining—Aft of Axle Fuel Tank](#)

[Draining—Fuel Filter Water](#)

[Push Connect Fittings](#)

[Spring Lock Couplings](#)

[Hairpin Clip Fitting](#)

[Vapor Tube Fittings](#)

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SPECIFICATIONS

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General Specifications	
Item	Specification
Fuel Capacity	
Wide Frame Vehicles Standard Bed Midship Tank	144 liters (38 gallons)
Wide Frame Vehicles Short Bed Midship Tank	110 liters (29 gallons)
Narrow Frame Chassis Cab Aft-of-Axle Tank Standard Equipment	139 liters (36 gallons)
Narrow Frame Chassis Cab Midship Tank (Optional)	69 liters (19 gallons)
Motor Home Chassis Aft-of-Axle Tank	283 Liters (75 gallons)
Fuel Pressure	

5.4L and 6.8L Gasoline Engine Running kPa (psi)	193-310 (28-45)
5.4L and 6.8L Gasoline Engine—Key On Engine Off kPa (psi)	240-310 (35-45)
7.3L Diesel Operating Fuel Line Primary Pump Pressure kPa (psi)	352 ± 28 (51 ± 4)
Lubricants	
Engine Oil	WSS-M2C153-G

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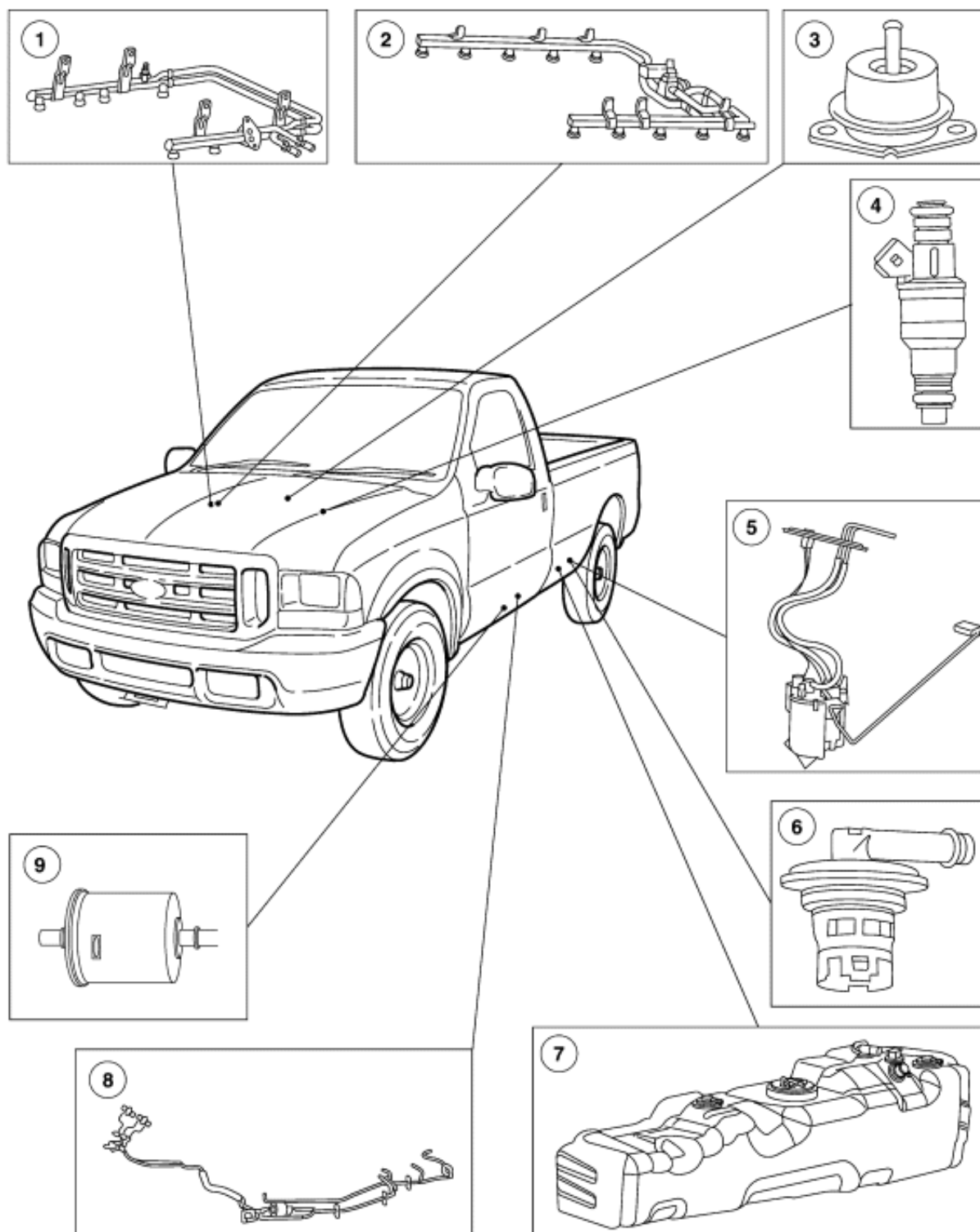
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DESCRIPTION AND OPERATION

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Fuel System—Gasoline Engines

Component Location



AV1099-A

Item	Part Number	Description
1	9D280	Fuel Injection Supply Manifold (5.4L)
2	9D280	Fuel Injection Supply Manifold (6.8L)
3	9C968	Fuel Pressure Regulator

4	9F593	Fuel Injector
5	9350	Fuel Pump
6	9B593	Vapor Valve
7	9002	Fuel Tank
8	9S278	Rear Fuel Supply Return and Vapor Tube
9	9155	Fuel Filter



WARNING: The fuel in the fuel system remains under high pressure even when the engine is not running. Before repairing or disconnecting any of the fuel lines or fuel system components, the fuel system pressure must be relieved to prevent accidental spraying of fuel, causing personal injury or a fire hazard.

The vehicle:

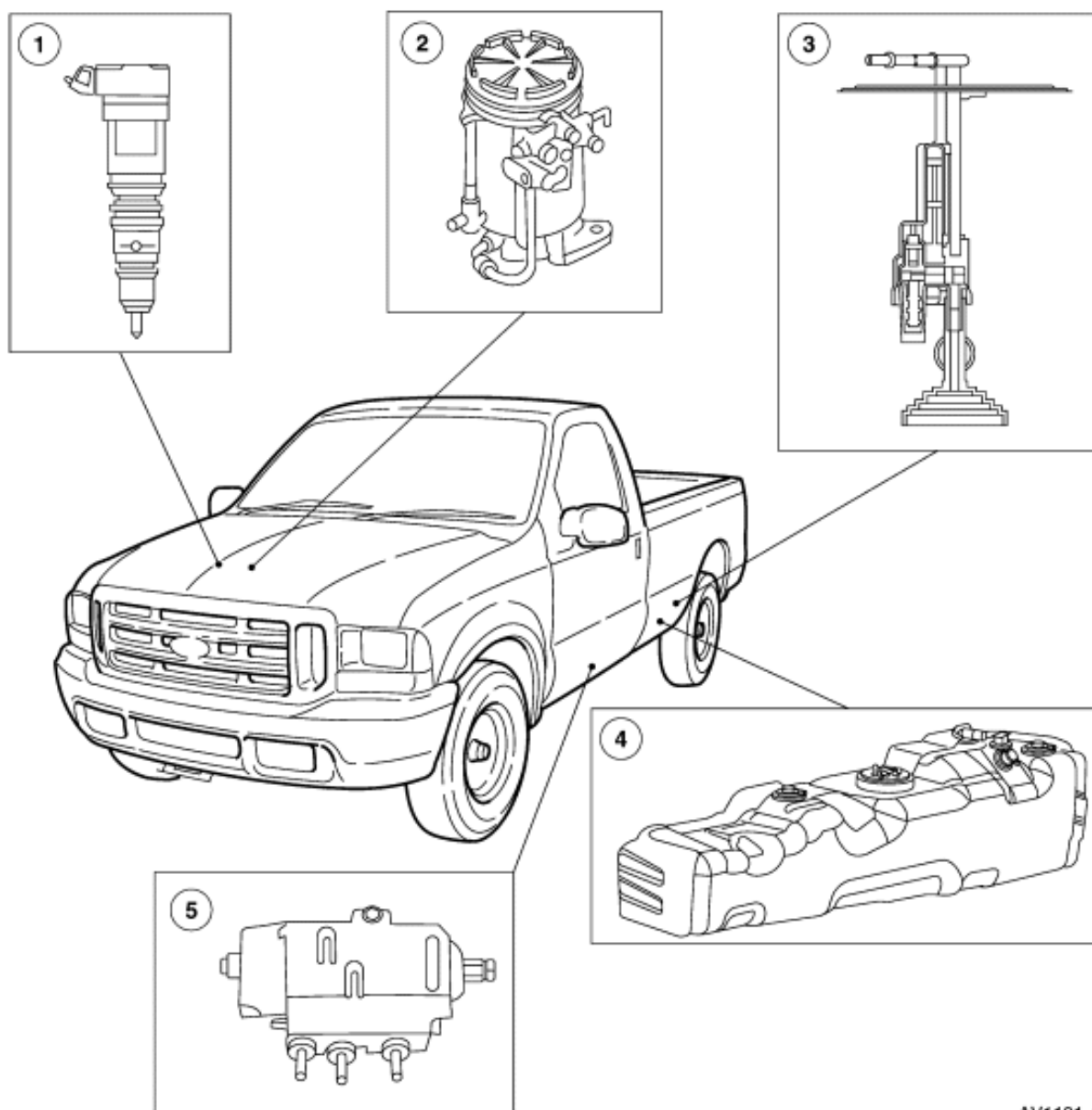
- is equipped with a multiport fuel injection (MFI) system.
- has separately controlled fuel injectors mounted to the intake manifold for each cylinder.
- has fuel injectors which are supplied with pressurized fuel from the fuel pump through the fuel injection supply manifold.
- has a fuel injection supply manifold which is equipped with a fuel pressure regulator.
- has a fuel pressure regulator controlling the pressure to the fuel injectors.
- has excess fuel to the fuel injectors returned to the fuel tank.

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Fuel System—Diesel Engines

Component Location—Diesel



AV1101-A

Item	Part Number	Description
1	9F593	Fuel Injector
2	9155	Fuel Filter (Heater and Water Separator Assembly)
3	9275	Fuel Level Sensor
4	9002	Fuel Tank (Midship Shown)
5	9350	Fuel Pump (Electric Frame Mount)

The fuel system for the 7.3L direct injection turbo (DIT) diesel:

- is controlled by the powertrain control module (PCM).

- utilizes an electric, frame mounted fuel pump.
- incorporates a fuel filter and water separator assembly.
- incorporates an internal check valve with a built-in orifice that will bleed off system pressure approximately ten minutes after the pump is shut off.

The electric fuel pump:

- draws fuel from the fuel tank.
- circulates fuel under pressure through the fuel filter and water separator and the pressure regulator to the cylinder head fuel galleries and to the fuel injectors.

Excess fuel is returned to the fuel tank through the fuel return hose.

Fuel Filter/Water Separator

The diesel engine is equipped with a fuel filter and water separator assembly. Drain the water from the fuel filter at the recommended maintenance intervals. Refer to the Service Guide for the maintenance intervals.

A water in fuel indicator on the instrument panel will alert the operator. When the indicator glows continuously while the engine is running, drain the water from the fuel filter and water separator bowl as soon as possible to prevent damage to the fuel injection system; refer to [Draining—Fuel Filter Water](#) in this section.

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Fuel System

Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

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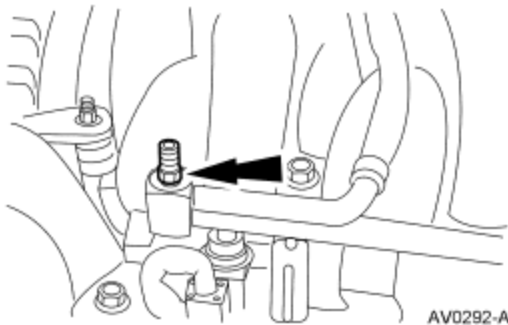
Pressure Relief

Special Tool(s)	
 ST1371-A	EFI/CFI Fuel Pressure Gauge 310-012 (T80L-9974-B)

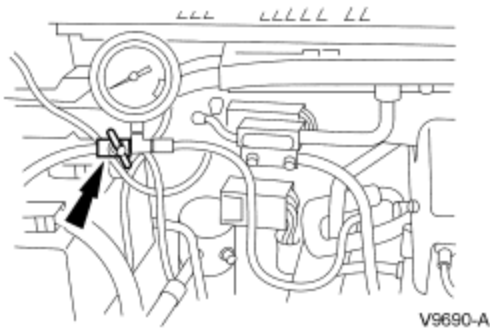
⚠ WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related component. Highly flammable mixtures are always present and may be ignited, resulting in possible personal injury.

⚠ WARNING: Fuel in the fuel system remains under high pressure even when the engine is not running. Before servicing or disconnecting any of the fuel lines or fuel system components, the fuel system pressure must be relieved to prevent accidental spraying of fuel, causing personal injury or a fire hazard.


1. Remove the Schrader valve cap and install the EFI/CFI Fuel Pressure Gauge.




2. Open the manual valve slowly on the EFI/CFI Fuel Pressure Gauge and relieve the fuel pressure.
 - This will drain some fuel out of the system; place the fuel in a suitable container.

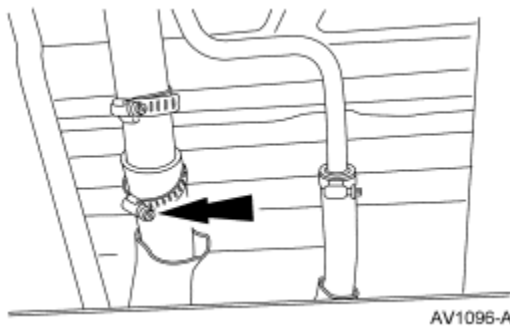


Draining—Midship Fuel Tank

Special Tool(s)	
 ST1114-A	30 Gallon Gasoline Hand Pump Storage Tanker 164-R3201 or equivalent

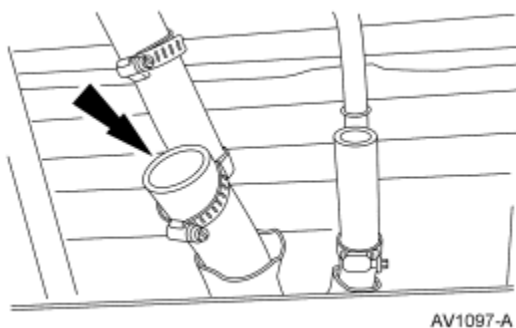
 **WARNING:** Do not smoke or carry lighted tobacco or have open flame of any type when working on or near any fuel related component. Highly flammable mixtures are always present and may be ignited, resulting in possible personal injury or property damage.

1. Disconnect the battery ground cable (14301).
2. Raise and support the vehicle.
3. Remove the filler pipe hose at the filler pipe hose connection. Loosen the clamp and disconnect the hose.



4. **NOTE:** Follow the operating instructions supplied by the equipment manufacturer.


Insert the hose from the storage tanker and siphon the fuel through the evaporative emission valve opening.



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Draining—Aft of Axle Fuel Tank

Special Tool(s)	
 ST1114-A	30 Gallon Gasoline Hand Pump Storage Tanker 164-R3201 or equivalent

1. Disconnect the battery ground cable.
 2. Raise and support the vehicle.
 3. Position the storage tanker beneath the fuel tank and remove the drain plug.
-

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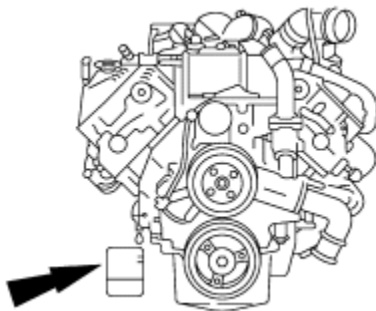
Draining—Fuel Filter Water



WARNING: The vehicle must be stopped with the engine off when draining the fuel filter water bowl. Fuel can ignite if the fuel filter is drained while the engine is running.

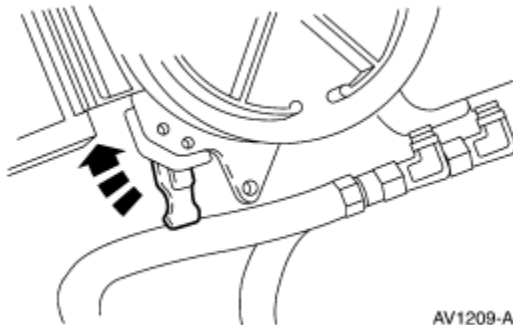
NOTE: Diesel fuel can damage asphalt and other surfaces. Always place an appropriate container under the fuel filter water drain and dispose of the waste in accordance with all federal, state and local requirements.

1. Place an appropriate container under the fuel filter water drain underneath the vehicle.



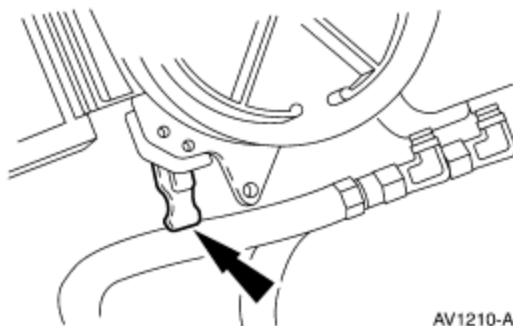
AV1208-A

2. Open the fuel filter water drain valve release lever. Allow the fuel to drain for approximately 30 seconds or until clean fuel is observed.



AV1209-A

3. Close the drain valve by resetting the lever to its original position.




AV1210-A

4. Remove the container from under the vehicle. Dispose of waste properly.

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Push Connect Fittings

Special Tool(s)	
 ST1399-A	Fuel Line Disconnect Tool 310-S039 (T90T-9550-S)

Disconnect

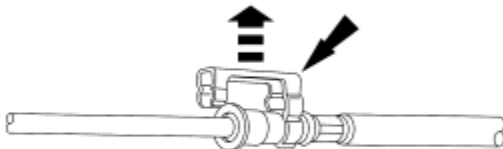


WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related component. Highly flammable mixtures are always present and may be ignited, resulting in possible personal injury.



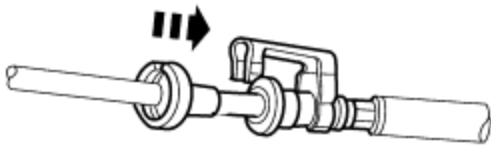
WARNING: Fuel in the fuel system remains under high pressure even when the engine is not running. Before servicing or disconnecting any of the fuel lines or fuel system components, the fuel system pressure must be relieved to prevent accidental spraying of fuel, causing personal injury or a fire hazard.

1. Relieve the fuel pressure; refer to [Pressure Relief](#) in this section.
2. Disconnect the safety clip from the male hose.



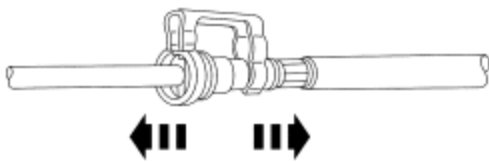
V9506-A

3. Install the fuel line disconnect tool and push into the fitting.



AV0311-A

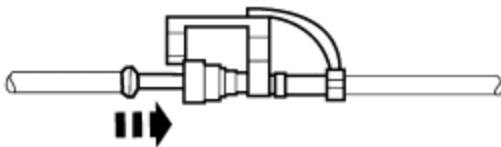
4. Separate the fittings.
 - Inspect for damage.
 - Clean the fittings.



V9483-A

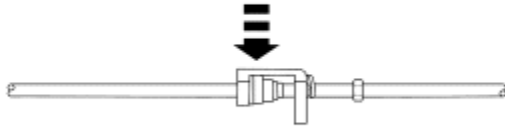
Connect

1. Connect the fitting.
 - Lubricate the tube end with clean engine oil meeting Ford specification WSS-M2C153-G to ease assembly.
 - Align the tube to the fitting and push until you hear a click.



AV0312-A

2. Pull on the fitting to make sure it is fully engaged, then install the safety clip.





V9485-A

SECTION 310-00: Fuel System — General
Information
GENERAL PROCEDURES

1999 F-Super Duty 250-550 Workshop
Manual

[Procedure revision date: 01/26/2000](#)

Spring Lock Couplings

Special Tool(s)	
	Disconnect Tool (3/8 inch) 310-D004 (D87L-9280-A) or equivalent
	Disconnect Tool (1/2 inch) 310-D005 (D87L-9280-B) or equivalent

Disconnect

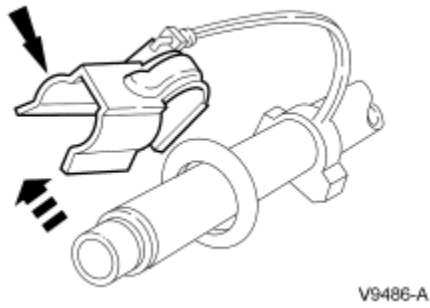


WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related component. Highly flammable mixtures are always present and may be ignited, resulting in possible personal injury.

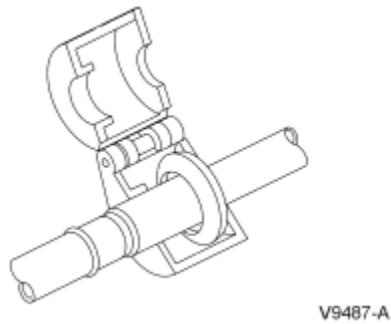


WARNING: Fuel in the fuel system remains under high pressure even when the engine is not running. Before servicing or disconnecting any of the fuel lines or fuel system components, the fuel system pressure must be relieved to prevent accidental spraying of fuel, causing personal injury or a fire hazard.

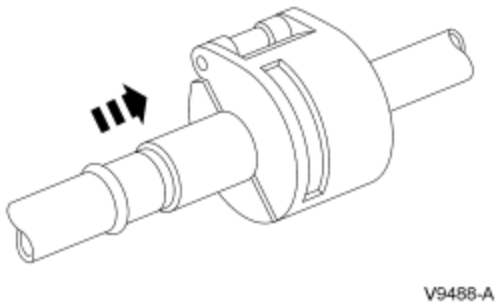
1. Relieve the fuel pressure; refer to [Pressure Relief](#) in this section.
2. Remove the fuel tube clip.



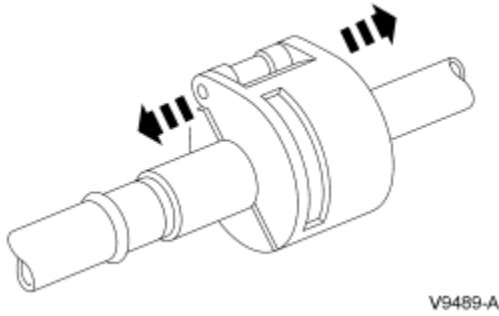
3. Install the Disconnect Tool.



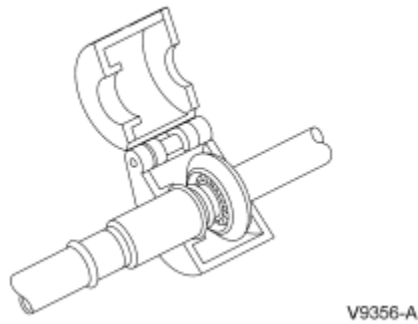
4. Close and push the Disconnect Tool into the open side of the cage.



5. Separate the fitting.

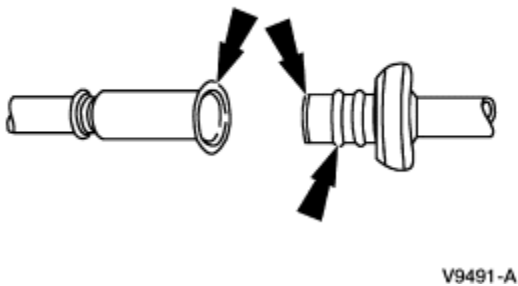


6. Remove the Disconnect Tool.



Connect

1. Connect the fitting.
 - Inspect and clean both the coupling ends.
 - Lubricate the O-rings with clean engine oil meeting Ford specification WSS-M2C153-G.
 - Connect the fitting.
 - Pull on the fitting to make sure it is fully engaged.
 - Install the safety clip.



Hairpin Clip Fitting

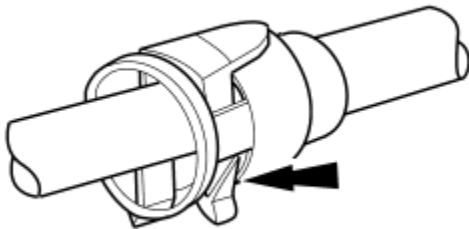
Disconnect

⚠ WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related component. Highly flammable mixtures are always present and may be ignited, resulting in possible personal injury.

⚠ WARNING: Fuel in the fuel system remains under high pressure even when the engine is not running. Before servicing or disconnecting any of the fuel lines or fuel system components, the fuel system pressure must be relieved to prevent accidental spraying of fuel, causing possible personal injury or a fire hazard.

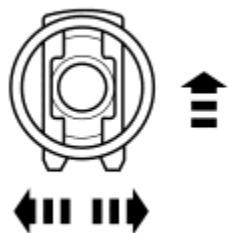
⚠ CAUTION: Do not use any tools. The use of tools may cause a deformity in the clip components which may cause fuel leaks.

1. Relieve the fuel pressure; refer to [Pressure Relief](#) in this section.



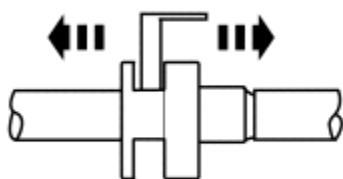
AV0313-A

2. Remove the shipping tab by bending downward.
3. Spread the hairpin clip legs and push the clip into the fitting.



AV0314-A

4. Separate the fitting from the tube.



AV0315-B

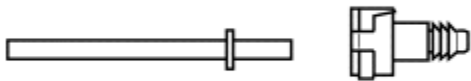
Connect

1. Inspect the fitting and the tube for damage. Remove any dirt or obstructions.
2. Apply a light coat of clean engine oil meeting Ford specification WSS-M2C153-G to the male tube end.
3. Insert the hairpin clip into the fitting.



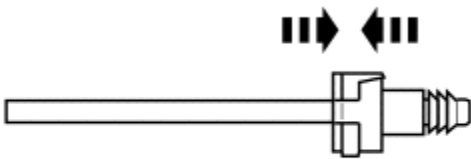
AV0316-A

4. Align the tube and the fitting.



AV0317-A

5. Insert the tube in the fitting and push together until a click is heard.



AV0318-A

6. Pull on the connection to make sure it is fully engaged.

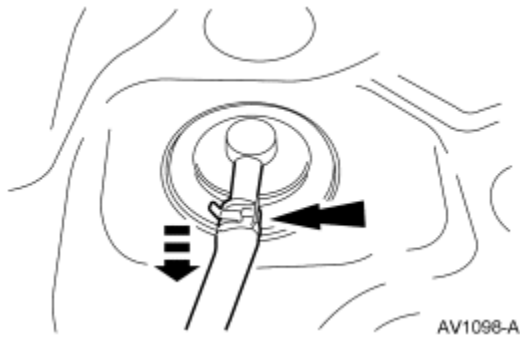


AV0319-A

Vapor Tube Fittings

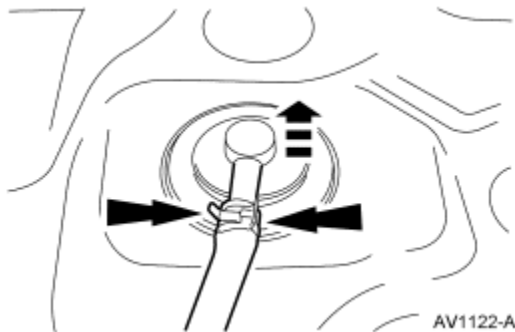
Disconnect

1. **⚠ WARNING:** The evaporative emission system contains fuel vapor and condensed fuel vapor. Although not present in large quantities, it still presents the danger of explosion or fire. Disconnect the battery ground cable from the battery to minimize the possibility of an electrical spark occurring, possibly causing a fire or explosion if fuel vapor or fuel liquid is present in the area.
2. Disconnect the vapor tube from the fitting. Remove by compressing the tabs of the clamp together and disconnecting the tube.



Connect

1. Inspect the fitting and the tube for damage.



2. Remove any dirt or obstructions.
 3. Compress the tabs on the clamp and install the vapor tube on the fitting.
-

SECTION 310-01: Fuel Tank and Lines

SPECIFICATIONS

DESCRIPTION AND OPERATION

[Fuel Tank and Lines](#)

DIAGNOSIS AND TESTING

[Fuel Tank and Lines](#)

REMOVAL AND INSTALLATION

[Fuel Tank—Midship](#)

[Fuel Tank—Aft-of-Axle](#)

[Fuel Tank—Motorhome Chassis](#)

[Support Straps](#)

[Pump—Midship Tank, Gasoline Engines](#)

[Pump—Aft of Axle Tank, Gasoline Engines](#)

[Pump—Electric](#)

[Fuel Pump Relay](#)

[Filler Pipe](#)

[Filter](#)

[Filter—Water Separator](#)

[Inertia Fuel Shutoff \(IFS\) Switch](#)

SECTION 310-01: Fuel Tank and Lines
SPECIFICATIONS

1999 F-Super Duty 250-550 Workshop Manual

[Procedure revision date: 01/26/2000](#)

General Specifications	
Item	Specification
Fuel Capacity	
Wide Frame Standard Bed Midship Tank	144 Liters (38 gal.)
Wide Frame Short Bed Midship Tank	110 Liters (29 gal.)
Narrow Frame Chassis Cab Aft-of-Axle Tank Standard Equipment	139 Liters (36 gal.)
Narrow Frame Chassis Cab Midship Tank (Optional)	69 Liters (18 gal.)

Motorhome Chassis Aft-of-Axle Tank	2.83 liters (75 gal.)
Fuel Pressure Specifications—7.3L Diesel Engine	
Key On Engine Running kPa (psi)	276-414 (40-60)
Key On Engine Off kPa (psi)	0-414 (0-60)

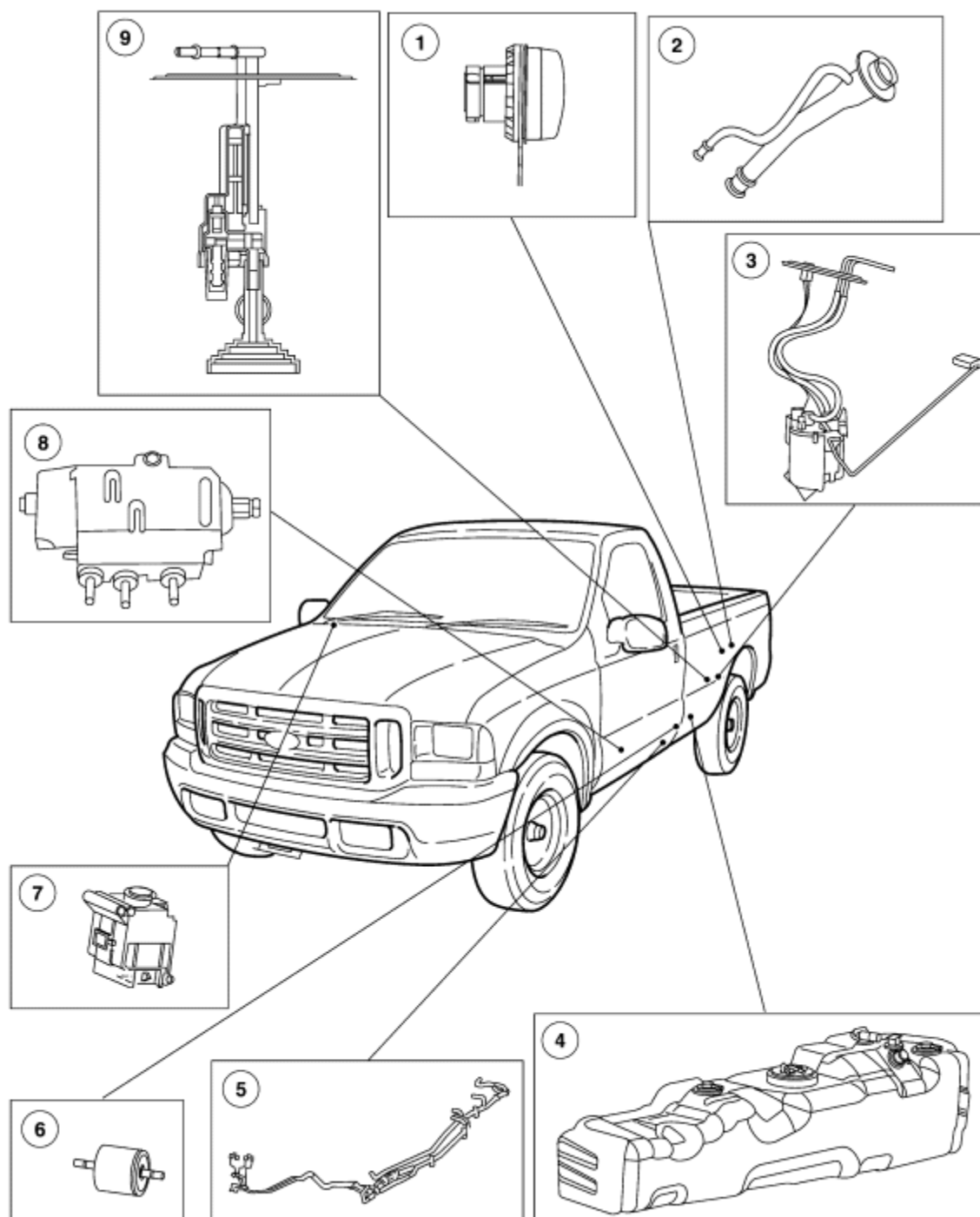
Torque Specifications			
Description	Nm	lb-ft	lb-in
Fuel Pump Bolts (Aft-of-Axle)	9-12	—	80-107
Fuel Pump Nuts (Diesel)	17	13	—
Fuel Pump Locking Retaining Ring (Midship Tanks)	68-95	50-70	—
Motorhome Chassis Fuel Tank Support Strap Bolts	68-92	50-68	—
Fuel Tank Filler Pipe Screws	2-4	—	18-35
Fuel Tank Support Strap Bolts (Midship Tank)	34-46	25-33	—
Fuel Tank Support Strap Bolts (Aft-of-Axle Tank)	80-100	59-73	—
Inertia Fuel Shutoff Switch Bolts	0.5-1.0	—	5-8
Skid Plate Bolts	17-23	—	13-16
Fuel Level Sensor (Diesel)	9-12	—	80-107

SECTION 310-01: Fuel Tank and Lines
DESCRIPTION AND OPERATION

1999 F-Super Duty 250-550 Workshop Manual
[Procedure revision date: 01/26/2000](#)

Fuel Tank and Lines

Fuel System Component Location—Midship Fuel Tank

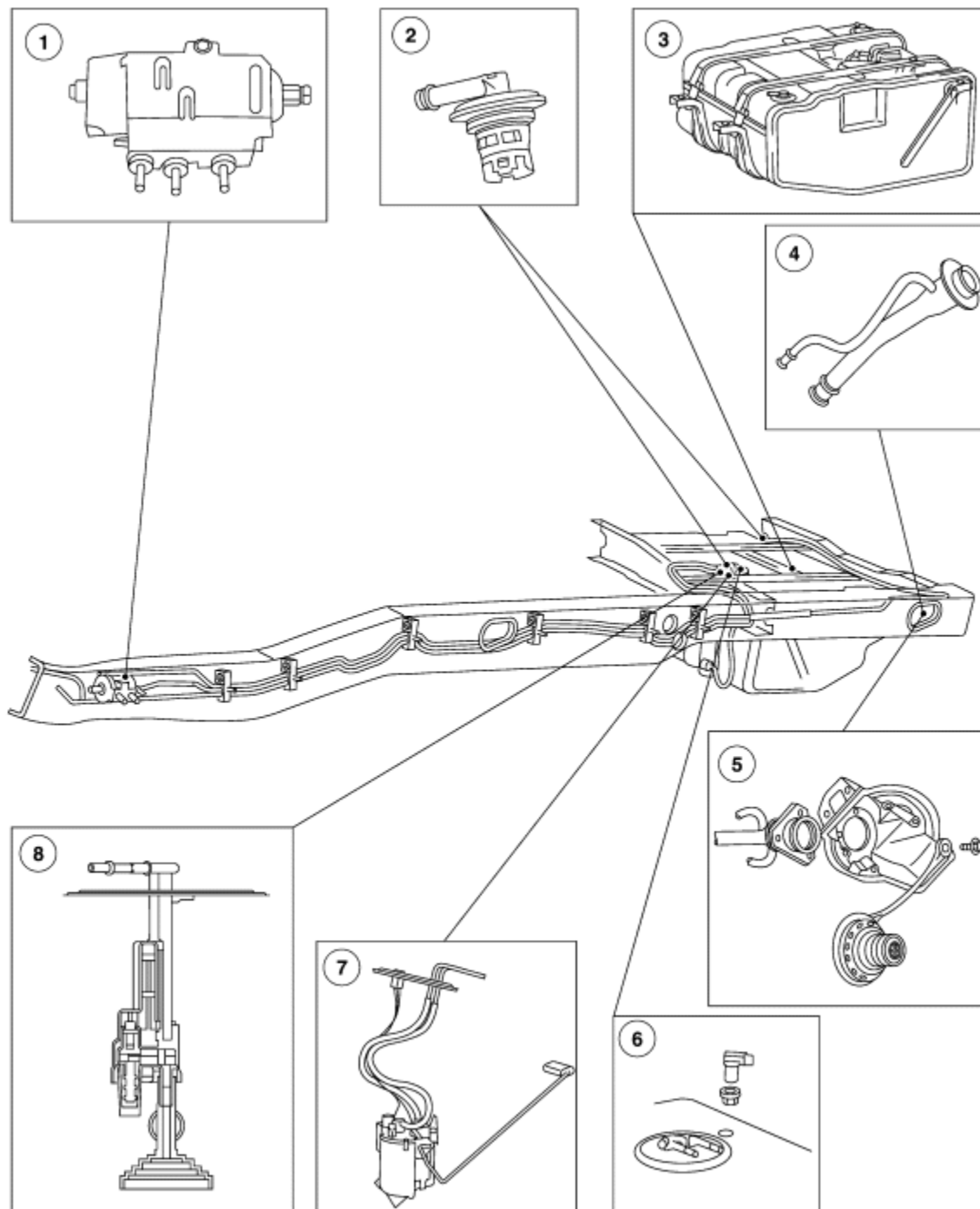


AV1126-A

Item	Part Number	Description
1	9030	Fuel Tank Filler Cap
2	9034	Fuel Tank Filler Pipe
3	9350	Fuel Pump (Gasoline)
4	9002	Fuel Tank
5	9S278	Rear Fuel Supply Return and Vapor Tube

6	9155	Fuel Filter
7	9341	Inertia Fuel Shutoff Switch
8	9350	Fuel Pump (Diesel)
9	9275	Fuel Level Sensor (Diesel)

Fuel System Component Location—Aft of Axle Tank



Item	Part Number	Description
1	9350	Fuel Pump (Diesel)
2	9B593	Evaporative Emission Valve
3	9002	Fuel Tank
4	9034	Fuel Tank Filler Pipe
5	9030	Fuel Tank Filler Cap (Diesel)
6	9C052	Fuel Tank Pressure Sensor
7	9350	Fuel Pump (Gasoline)
8	9275	Fuel Level Sensor (Diesel)

Gasoline Engines

The fuel system consists of:

- the fuel tank (9002).
 - The midship fuel tank is mounted to the LH frame side rail.
 - The aft of axle fuel tank is mounted between the side rails.
- a fuel tank filler pipe (9034) which contains a restrictor plate to permit only unleaded fuel to be pumped into the fuel tank.
- a 1/8 turn fuel tank filler cap (9030).
- a fuel filter (9155) providing filtration to protect the fuel injectors.
- fuel lines.
- a fuel pressure regulator.
- a fuel pump (9350) which provides pressurized fuel to the engine and contains:
 - a serviceable fuel sender
 - an inlet filter
 - a check valve which maintains system pressure after the pump is shut off.
 - a pressure relief valve for overpressure protection in the event of restricted flow.

The fuel pump is controlled by the fuel pump powertrain control module relay. Electrical power to the fuel pump is provided through the inertia fuel shutoff switch (IFS switch) (9341).

Diesel Engines

The fuel system consists of:

- the fuel tank.
 - The midship fuel tank is mounted to the LH frame side rail.
 - The aft of axle fuel tank is mounted between the side rails.
- a fuel tank filler pipe without a restrictor plate.
- a threaded fuel tank filler cap.
- a fuel filter and water separator to protect the fuel injectors.
- a fuel circulation/filter unit (located inside the fuel tank on the fuel sender assembly).
- fuel lines.

- an internal check valve with a built in orifice that will allow system pressure to bleed off after approximately 10 minutes after the pump is shut off.
- frame mounted in-line fuel pump which provides pressurized fuel to the engine and contains:
 - an integral non-serviceable coarse inlet filter.
 - a pressure relief valve for overpressure protection in the event of restricted flow.

The fuel pump is controlled by the fuel pump powertrain control module relay. Electrical power to the fuel pump is provided through the inertia fuel shutoff switch (IFS switch).

The fuel recirculation/filter unit assist in preventing the fuel from getting in the fuel lines during cold weather operations.

SECTION 310-01: Fuel Tank and Lines
DIAGNOSIS AND TESTING

1999 F-Super Duty 250-550 Workshop Manual
[Procedure revision date: 01/26/2000](#)


Fuel Tank and Lines

Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

SECTION 310-01: Fuel Tank and Lines
REMOVAL AND INSTALLATION

1999 F-Super Duty 250-550 Workshop Manual
[Procedure revision date: 01/26/2000](#)

Fuel Tank—Midship

Special Tool(s)	
	Fuel Line Disconnect Tool 310-S039 (T90T-9550-S)



High-Lift Transmission Jack
014-00942 or equivalent

Removal

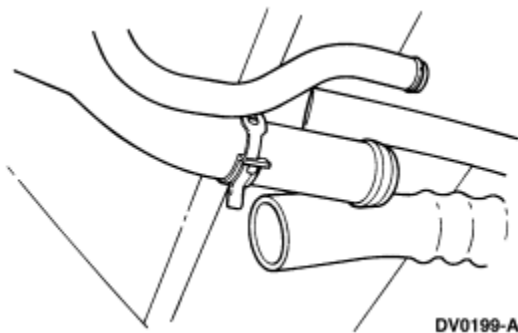


WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related component. Highly flammable mixtures are always present and may be ignited, resulting in possible personal injury.



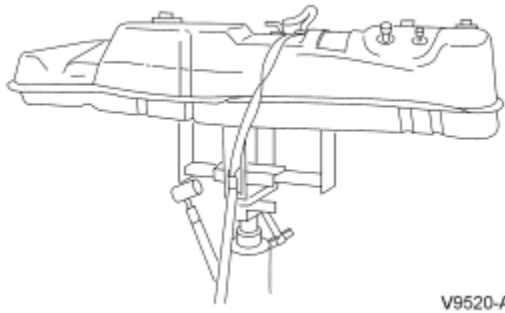
WARNING: Fuel in the fuel system remains under high pressure even when the engine is not running. Before repairing or disconnecting any of the fuel lines or fuel system components, the fuel system pressure must be relieved to prevent accidental spraying of fuel, causing personal injury or a fire hazard.

1. Disconnect the battery ground cable.
2. Relieve the fuel pressure; refer to [Section 310-00](#).
3. Drain the fuel from the fuel tank (9002); refer to [Section 310-00](#).
4. Raise and support the vehicle.
5. Disconnect the fuel tank filler pipe hose and the filler pipe vent tube.



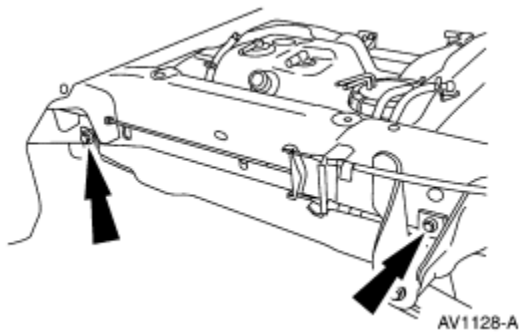
6. **NOTE:** If equipped, the skid plate must be removed.

Position the jack under the fuel tank.

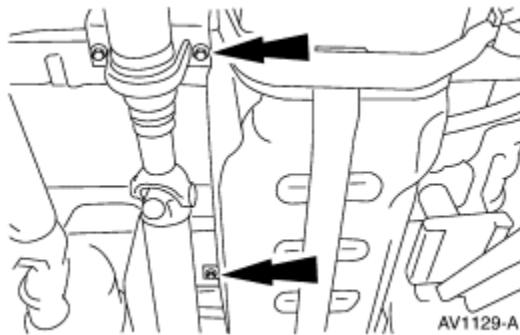


7. **NOTE:** The body has been removed in illustration for clarity.

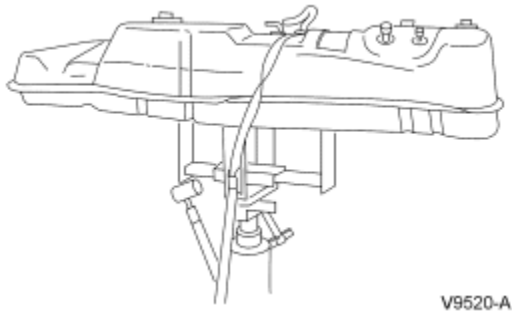
Remove the bolts.



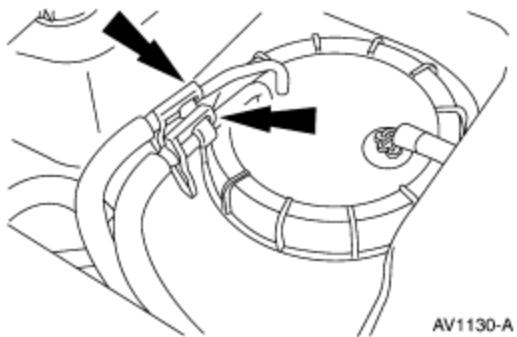
8. Remove the bolts.



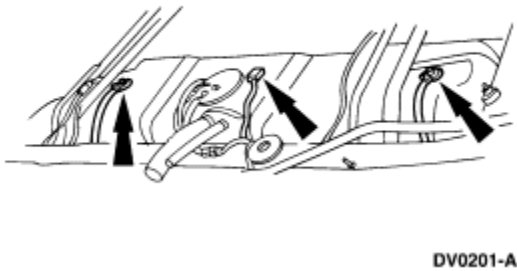
9. Partially lower the fuel tank.



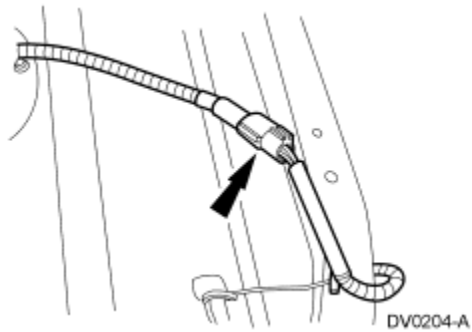
10. Use the Fuel Line Disconnect Tool to disconnect the fuel lines from the fuel pump; refer to [Section 310-00](#).



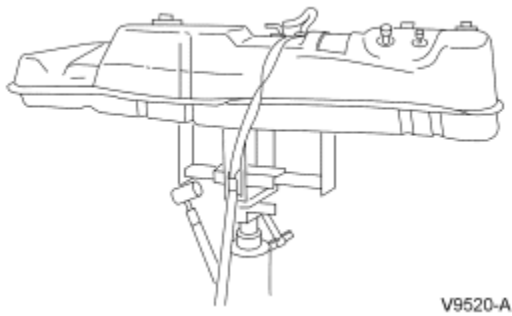
11. Disconnect the fuel tank connections.
- Disconnect the evaporative emission return tubes.
 - Disconnect the fuel tank pressure sensor connector.



12. Disconnect the fuel pump electrical connector.



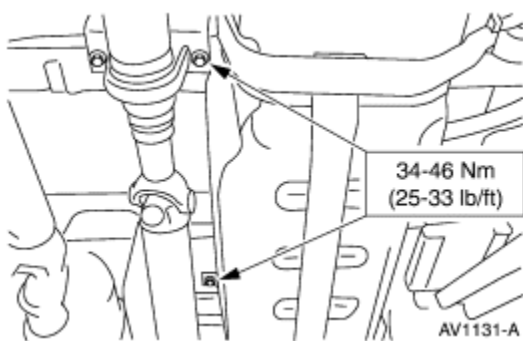
13. Lower the fuel tank.

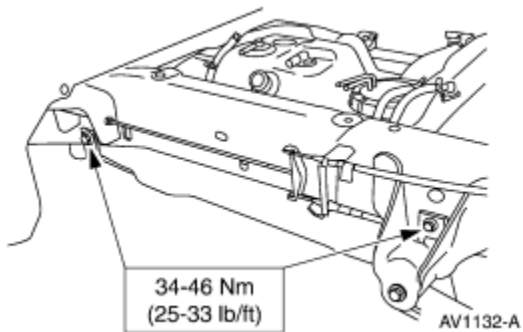


14. If the fuel tank is being replaced, transfer the fuel pump, fuel tank sending unit, the evaporative emissions valves, and the fuel tank pressure sensor (if equipped) to the new fuel tank.

Installation

1. Follow the removal procedure in reverse order.





SECTION 310-01: Fuel Tank and Lines REMOVAL AND INSTALLATION

1999 F-Super Duty 250-550 Workshop Manual

[Procedure revision date: 01/26/2000](#)

Fuel Tank—Aft-of-Axle

Special Tool(s)	
<p>ST1399-A</p>	Fuel Line Disconnect Tool 310-S039 (T90T-9550-S)
	High-Lift Transmission Jack 014-00942 or equivalent

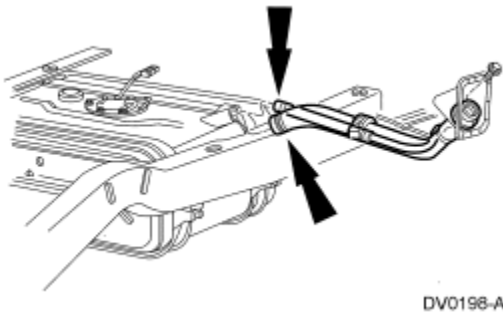
Removal

⚠ WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related component. Highly flammable mixtures are always present and may be ignited, resulting in possible personal injury.

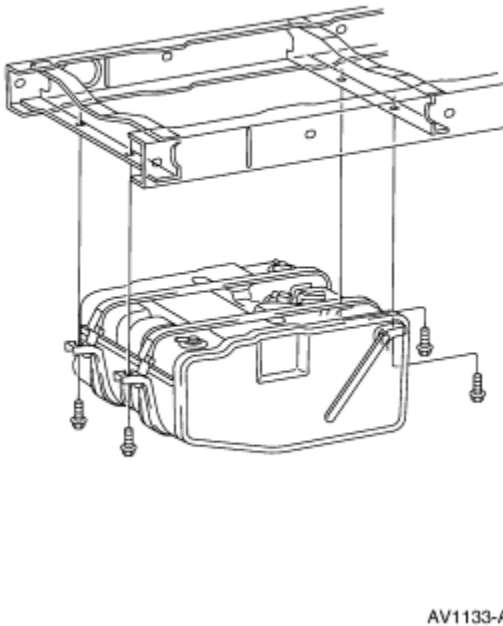
⚠ WARNING: Fuel in the fuel system remains under high pressure even when the engine is not running. Before repairing or disconnecting any of the fuel lines or fuel system components, the fuel system pressure must be relieved to prevent accidental spraying of fuel, causing personal injury or a fire hazard.

1. Disconnect the battery ground cable.
2. Relieve the fuel pressure; refer to [Section 310-00](#).
3. Drain the fuel from the fuel tank (9002); refer to [Section 310-00](#).
4. Raise and support the vehicle.
5. **NOTE:** In this illustration, the vehicle body is shown removed for clarity.

Disconnect the fuel tank filler pipe (9034) and the filler vent tube from the fuel tank.

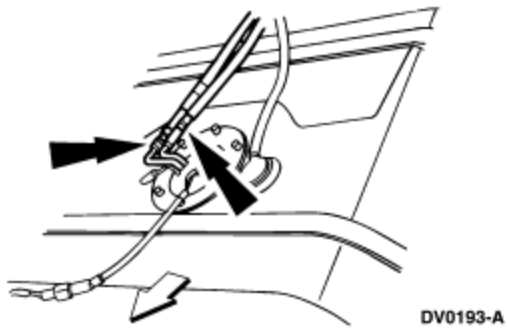


6. Position the jack under the fuel tank.
7. Remove the bolts.

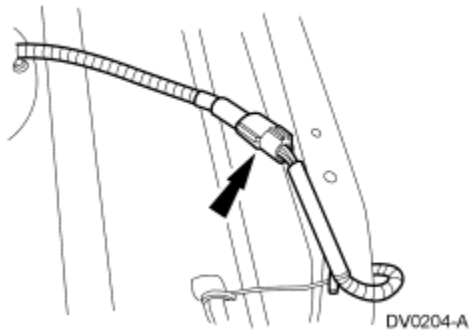


8. Partially lower the fuel tank.

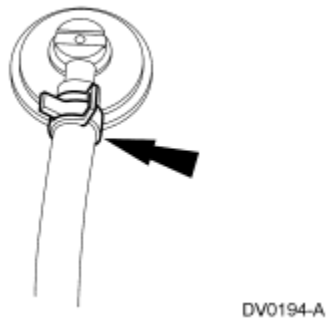
9. Disconnect the fuel lines from fuel pump; refer to [Section 310-00](#).



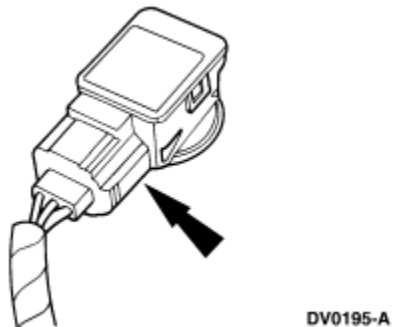
10. Disconnect the fuel pump and fuel tank sending unit electrical connector.



11. On gasoline fuel tanks, disconnect the hose(s) from the evaporative emission valve.



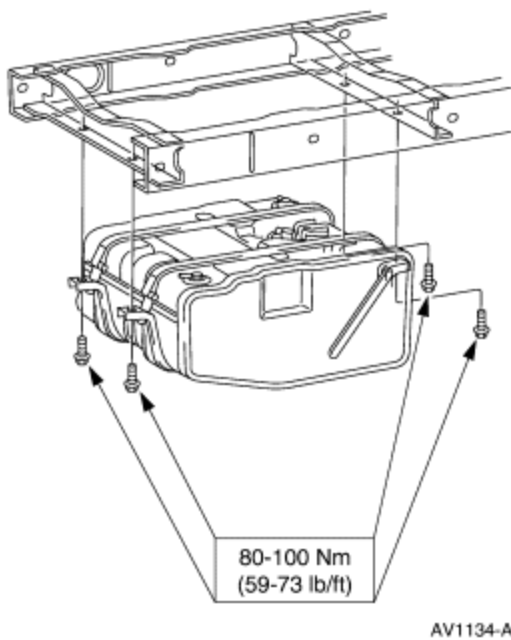
12. On gasoline fuel tanks only, disconnect the fuel tank pressure sensor electrical connector.



13. Lower the fuel tank.
14. If the fuel tank is being replaced, transfer the fuel pump, fuel tank sending unit, the evaporative emission valves and the fuel tank pressure sensor (gasoline fuel tanks) or the plug (diesel fuel tanks) to the new fuel tank.



Installation

1. Follow the removal procedure in reverse order.



Fuel Tank—Motorhome Chassis

Special Tool(s)

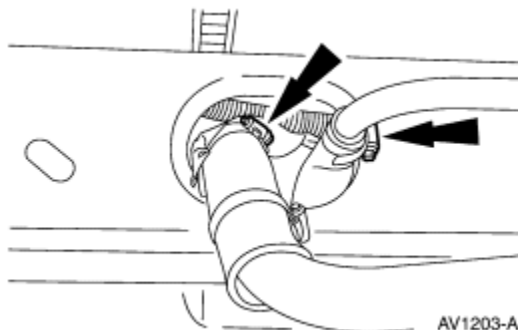
 ST1399-A	Fuel Line Disconnect Tool 310-S039 (T90T-9550-S)
 ST1130-A	High-Lift Transmission Jack 014-00942 or equivalent

Removal

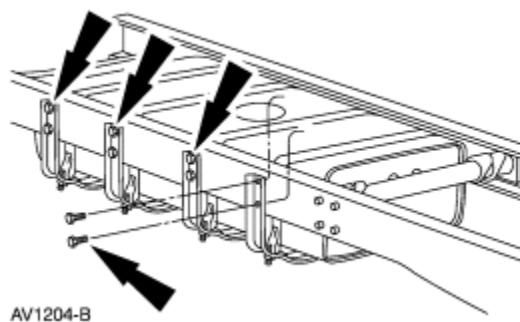
⚠ WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related component. Highly flammable mixtures are always present and may be ignited, resulting in possible personal injury.

⚠ WARNING: Fuel in the fuel system remains under high pressure even when the engine is not running. Before repairing or disconnecting any of the fuel lines or fuel system components, the fuel system pressure must be relieved to prevent accidental spraying of fuel, causing personal injury or a fire hazard.

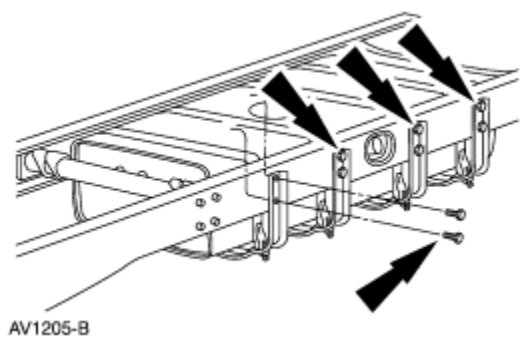
1. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
2. Relieve the fuel pressure. For additional information, refer to [Section 310-00](#).
3. Drain the fuel from the fuel tank (9002). For additional information, refer to [Section 310-00](#).
4. Raise and support the vehicle.
5. Disconnect the fuel tank filler pipe and the filler vent tube.



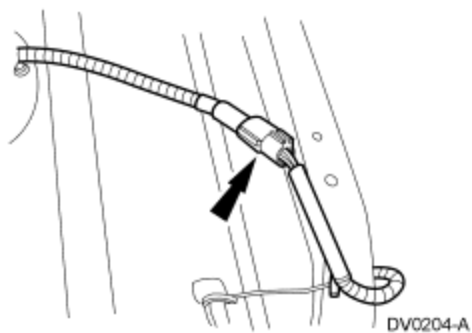
6. Position the jack under the fuel tank.
7. Remove the eight bolts from the RH frame rail.



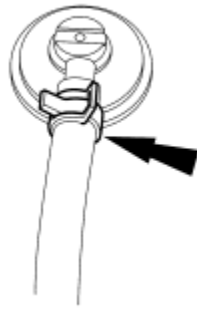
8. Remove the bolts from the LH frame rail.



9. Partially lower the fuel tank.
10. Disconnect the fuel lines from the fuel pump (9350). For additional information, refer to [Section 310-00](#).
11. Disconnect the fuel pump and fuel tank sending unit electrical connector.

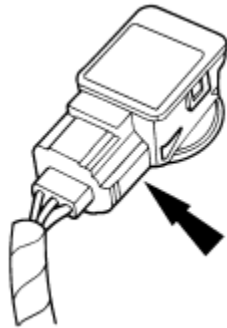


12. Disconnect the hose(s) from the evaporative emission valve (9B593).



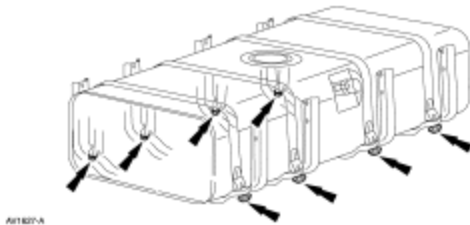
DV0194-A

13. Disconnect the fuel tank pressure sensor electrical connector.




DV0195-A

14. Lower the fuel tank.
15. If the fuel tank is being replaced, transfer the fuel pump, fuel tank sending unit, the evaporative emission valves and the fuel tank pressure sensor to the new fuel tank.
16. Remove the eight fuel tank strap nuts, and remove the fuel tank from the cradle.

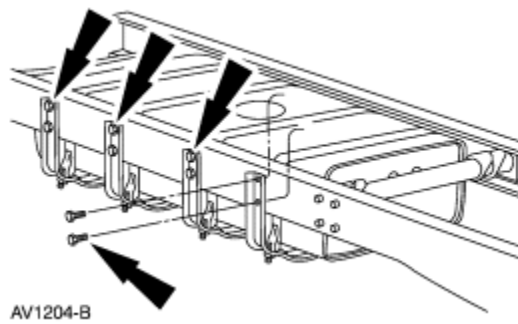


17. Remove the fuel tank straps from the fuel tank cradle brackets.

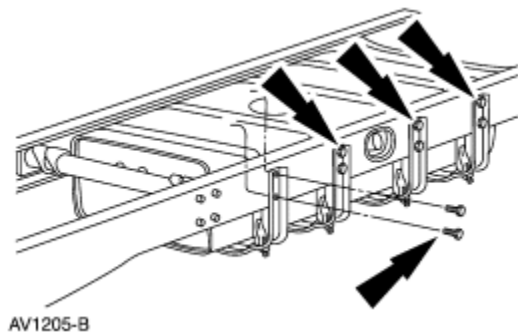
Installation

1. Position a new fuel tank in the cradle brackets.
2.  **CAUTION: Steps 2-4 must be followed to prevent damage to the fuel tank.**

Install the fuel tank straps and tighten the RH nuts with four threads showing.

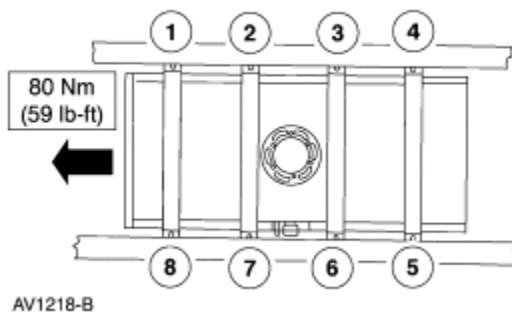


3. Tighten the LH fuel tank strap nuts.

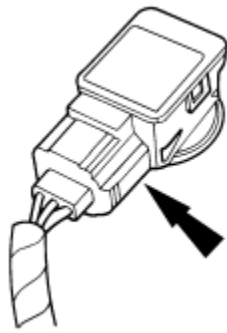


4. Position the fuel tank sub-assembly below the frame rail.
5. **NOTE:** The fuel tank must be loose in the cradle for proper positioning.

Tighten eight fuel tank strap nuts.

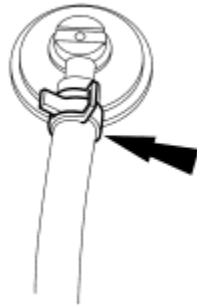


6. Connect the fuel tank pressure sensor electrical connector.



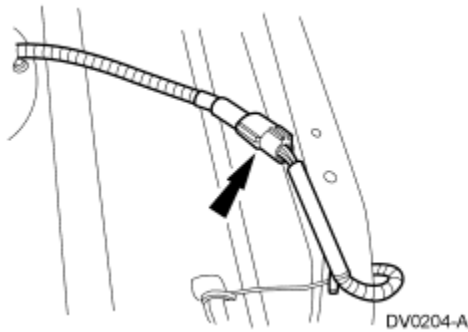
DV0195-A

7. Connect the hose at the evaporative emission valve.



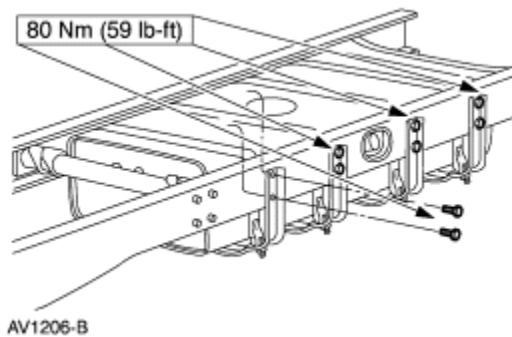
DV0194-A

8. Connect the fuel pump and fuel tank sending unit electrical connector.



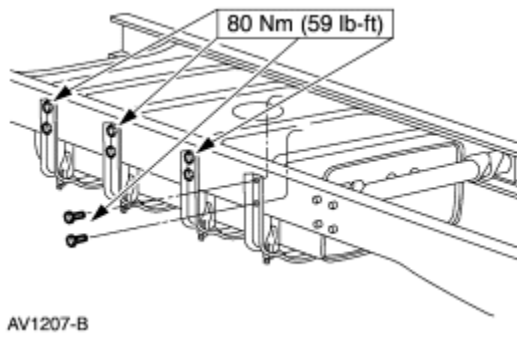
DV0204-A

9. Tighten the eight RH bolts.



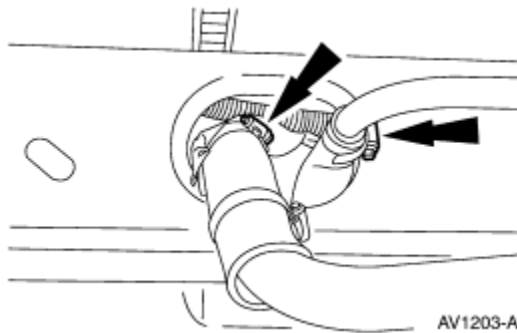
AV1206-B

10. Tighten the eight LH bolts.



11. Connect the fuel lines at the fuel pump. For additional information, refer to [Section 310-00](#).

12. Connect the fuel tank filler pipe and the filler vent tube.




13. Lower the vehicle.

14. Connect the battery.

Support Straps

Special Tool(s)

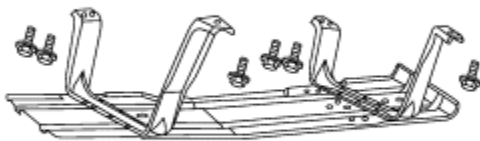
 <p>ST1130-A</p>	<p>High-Lift Transmission Jack 014-00942 or equivalent</p>
---	--

Removal

1. **NOTE:** Only the midship fuel tanks have support straps separate from the fuel tank. Aft of axle fuel tanks have support straps that are part of the fuel tank assembly and are not serviced separately.

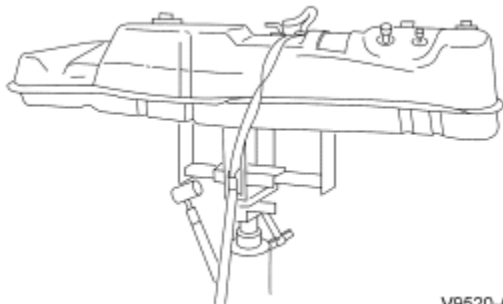
Raise and support the vehicle; refer to [Section 100-02](#).

2. If equipped, remove the fuel tank skid plate.



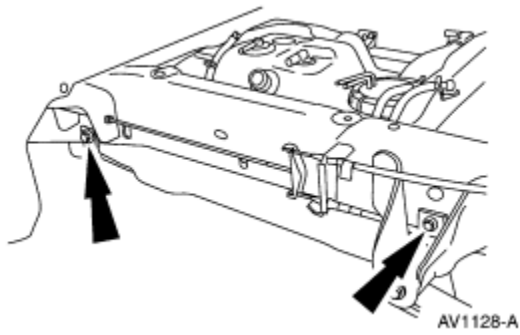
AV1108-A

3. Position a High-Lift Transmission Jack under the fuel tank.

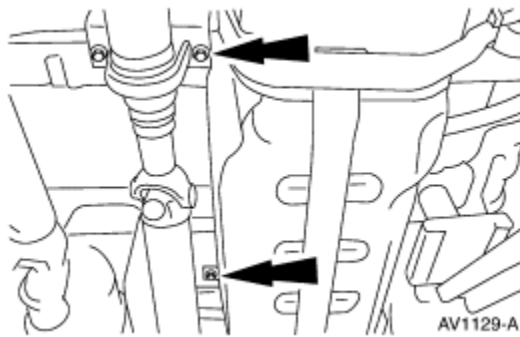


V9520-A

4. Remove the bolts.

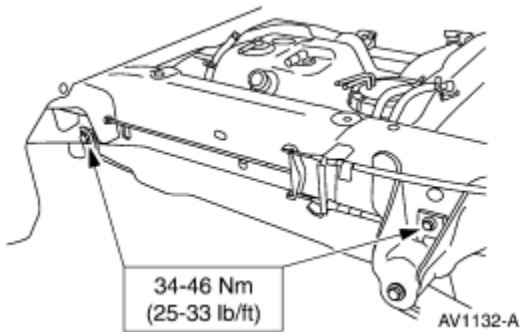
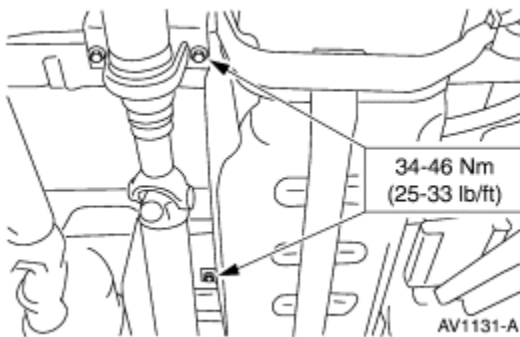


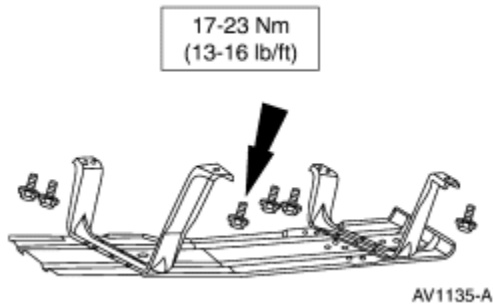
5. Remove the bolts and remove the fuel tank support strap.



Installation

1. Follow the removal procedure in reverse order.






SECTION 310-01: Fuel Tank and Lines REMOVAL AND INSTALLATION

1999 F-Super Duty 250-550 Workshop Manual

[Procedure revision date: 01/26/2000](#)

Pump—Midship Tank, Gasoline Engines

Special Tool(s)	
	Fuel Tank Locking Wrench T97T-9275-A

Removal

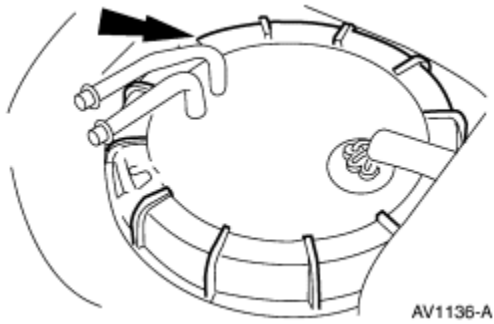
1. **NOTE:** For diesel engine applications, follow this procedure, Steps 1-3 to remove the diesel fuel level sensor.

NOTE: There is an optional steel midship tank on the narrow frame chassis cab models. For the optional tank, follow the Midship Fuel Pump procedure.

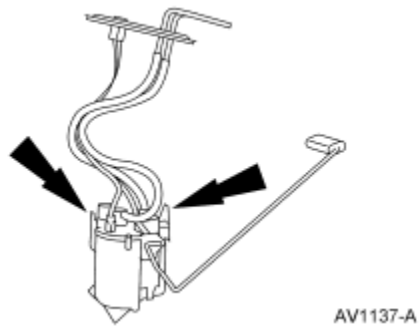
Remove the fuel tank; refer to [Fuel Tank—Midship](#) in this section.

2. Clean the area around the fuel pump mounting area.
3. **NOTE:** The fuel pump module must be handled carefully to avoid damage to the pump assembly.

Remove the locking retaining ring from the fuel tank mounting flange using the Fuel Tank Locking Wrench and lift up on the fuel pump sender flange to gain access to the pump module.



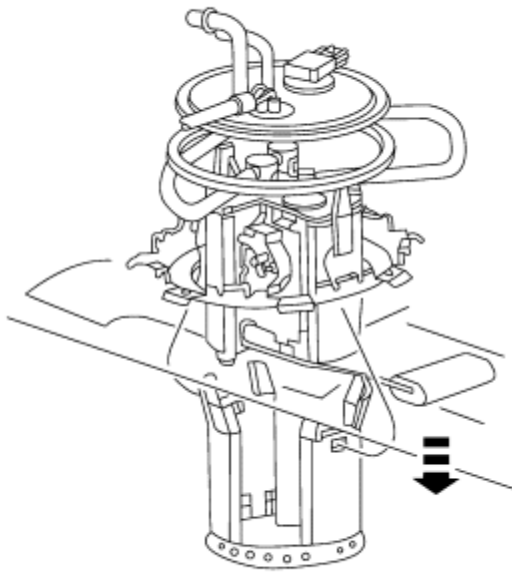
4. Reach into the tank to disconnect the retaining latches by squeezing the latches together while pushing down on the module to release the pump from the mounting bracket in the bottom of the fuel tank. Remove the pump assembly.



5. Remove and discard the fuel pump mounting gasket.

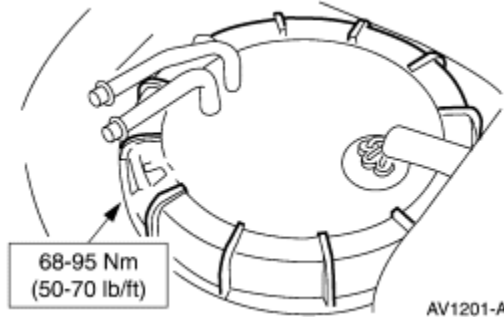
Installation

1. Clean and inspect the fuel pump mounting flange and the fuel tank mounting surface.
2. Connect the retaining latches of the pump module into the mounting bracket by aligning pump and pushing down until the pump is latched on both sides.



AV1143-A

3. Install a new fuel pump mounting gasket and install the fuel pump sender flange. Align the fuel pump tubes so they point toward the frame rail. Tighten the fuel pump retaining cap.



4. Install the fuel tank; refer to [Fuel Tank—Midship](#) in this section.
-

Pump—Aft of Axle Tank, Gasoline Engines

Removal

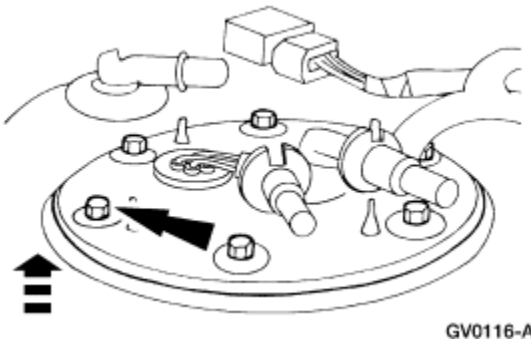
1. **NOTE:** Narrow frame chassis cab models do have an optional midship 18-gallon steel tank available. The motorhome chassis has an aft-of-axle 75 gallon steel tank. For such applications, refer to the following aft of axle procedure.

NOTE: For diesel engine applications, follow this procedure Steps 1-3 to remove the diesel fuel level sensor.

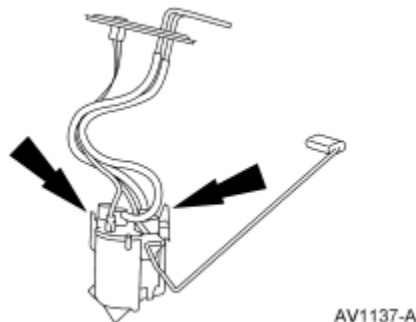
Remove the fuel tank; refer to [Fuel Tank—Aft-of-Axle](#) in this section.

2. Clean the area around the fuel pump mounting flange.
3. **NOTE:** The fuel pump module must be handled carefully to avoid damage.

Remove the bolts and lift up on the fuel pump sender flange.



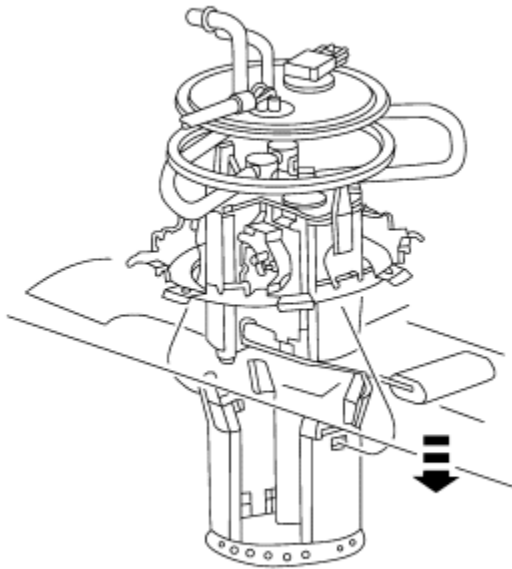
4. Depress the locking tabs on the pump while applying downward pressure on the pump module to release the pump from the mounting bracket. Remove the pump assembly.



5. Remove and discard the mounting flange gasket.

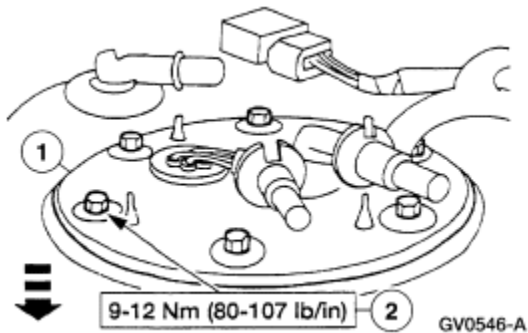
Installation

1. Clean and inspect the fuel pump mounting flange and the fuel tank mounting surface.
2. Connect the retaining latches of the pump module into the mounting bracket by aligning pump and pushing down until pump is latched on both sides.




AV1143-A

3. Install a new fuel pump.
 1. Install a new fuel pump mounting gasket and install fuel pump sender flange.
 2. Align the fuel pump tubes so they point to the front of the vehicle. Install the bolts.




4. Install the fuel tank; refer to [Fuel Tank—Aft-of-Axle](#) in this section.

Pump—Electric

Special Tool(s)	
 ST1399-A	Fuel Line Disconnect Tool 310-S039 (T90T-9550-S)

Removal

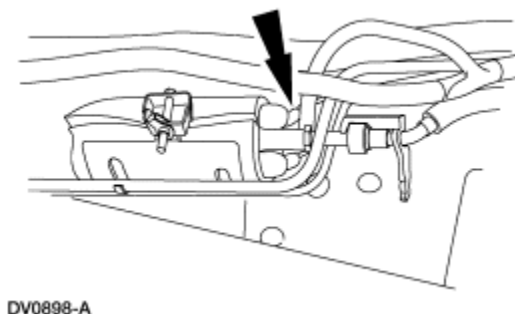
 **WARNING:** Smoking or open flame of any type must not be present when working near fuel or fuel vapor.

 **CAUTION:** The fuel system contains pressurized fuel after the vehicle is shut down and will maintain this pressure for a long period of time.

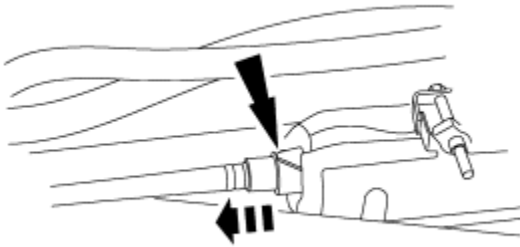
1. Disconnect both battery ground cables. On vehicles equipped with dual batteries, refer to [Section 414-01](#).
2. Open the fuel filter/water separator drain valve to release the fuel pressure.
3. Raise and support the vehicle; refer to [Section 100-02](#).
4. **NOTE:** The electrical connector is located behind the fuel pump near the frame rail.

Disconnect the fuel pump harness.

- Disconnect the fuel pump electrical connector.

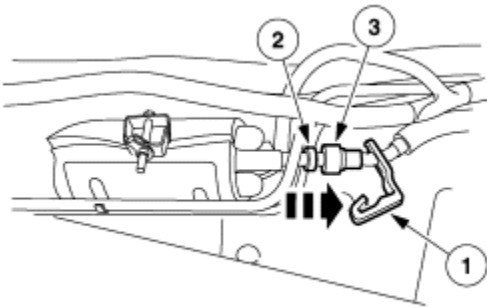


5. Disconnect the fuel pump supply line.
 - Remove the fuel line retaining clip and discard, then remove the fuel line from the fuel pump.



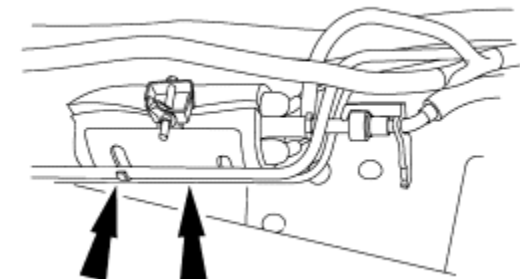
DV0899-A

6. Disconnect the fuel pump delivery line.
 1. Slide the clip up and off from the quick connect fitting.
 2. Insert the fuel line tool.
 3. Remove the fuel pump delivery line.



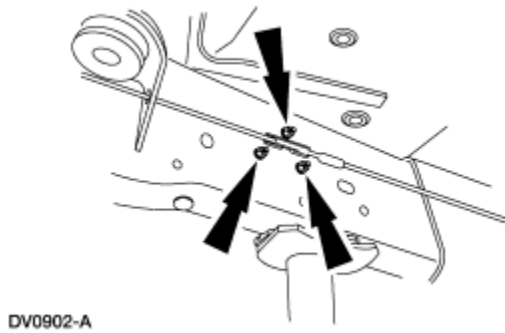
DV0900-A

7. Unclip the brake lines from the fuel pump bracket.

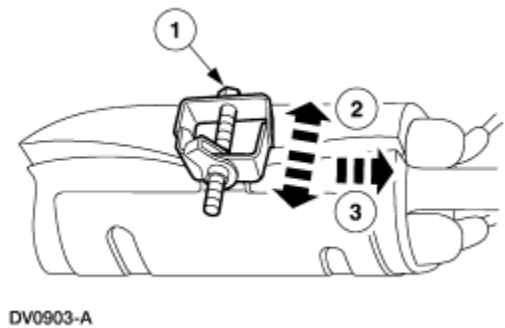


DV0901-A

8. Remove the pump mounting nuts, and the fuel pump.



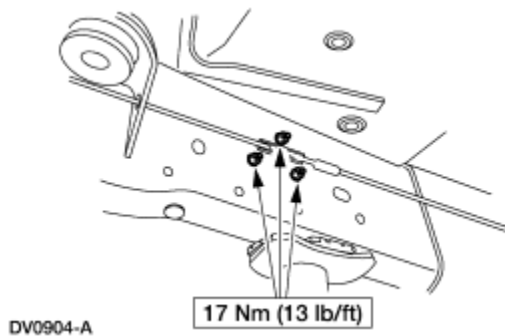
9. Remove the fuel pump from the mounting bracket.
 1. Loosen the pinch bolt.
 2. Spread the mounting bracket.
 3. Remove the fuel pump.



Installation

1. **NOTE:** On vehicles equipped with dual batteries, refer to [Section 414-01](#) for battery reconnect procedure.

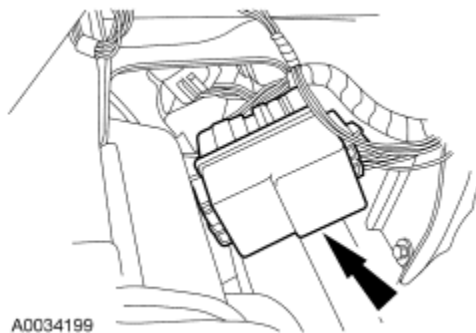
Follow the removal procedure in reverse order.



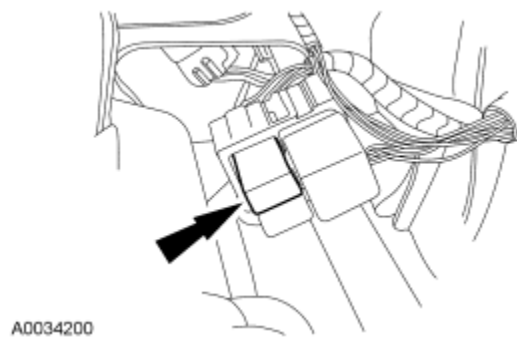
Fuel Pump Relay

Removal and Installation

1. Remove the radio. For additional information, refer to [Section 415-01](#).
2. Remove the relay cover.




3. Remove the fuel pump relay.



4. To install, reverse the removal procedure.
-

Filler Pipe

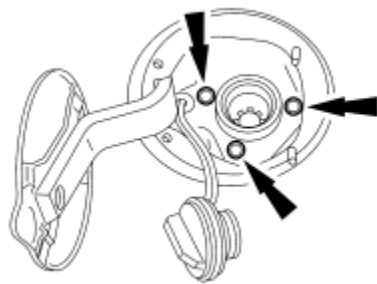
Removal

 **WARNING:** Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related component. Highly flammable mixtures are always present and may be ignited, resulting in possible personal injury.

1. **NOTE:** This procedure covers both midship and aft-of-axle filler pipes. Midship filler pipe is shown in the illustrations, the aft-of-axle is similar.

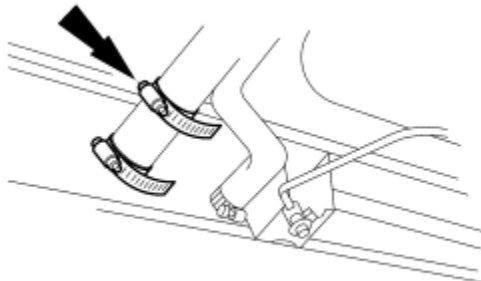
Remove the fuel tank filler cap.

2. Remove the screws.



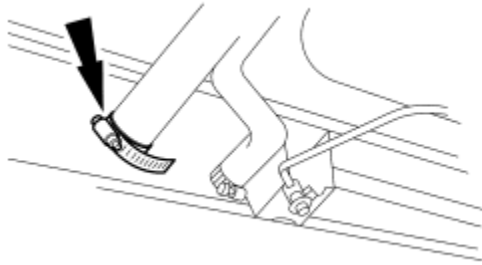
N12092-A

3. Loosen the hose clamp on the fuel tank filler pipe support and grounding bracket, if applicable.



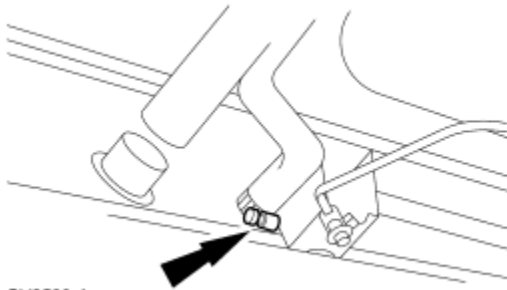
GV0571-A

4. Disconnect the fuel tank filler pipe hose from the fuel tank.



GV0570-A

5. Loosen the vent hose clamp and remove the fuel filler vent hose from the fuel tank.

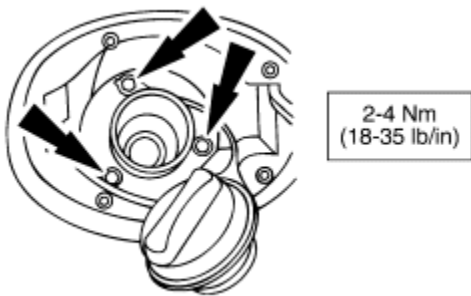


GV0569-A

6. Remove the fuel tank filler pipe.


Installation

1. Follow the removal procedure in reverse order.



AV1144-A

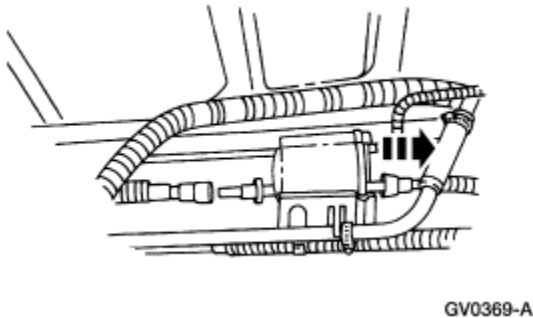
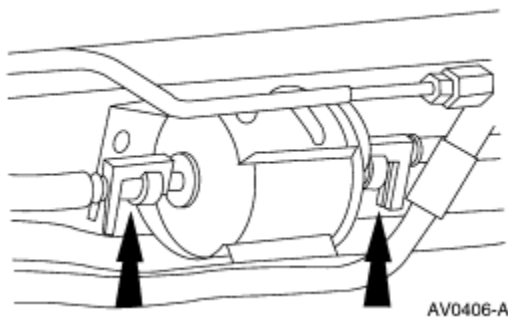
Filter

Special Tool(s)	
 ST1399-A	Fuel Line Disconnect Tool 310-S039 (T90T-9550-S)

Removal

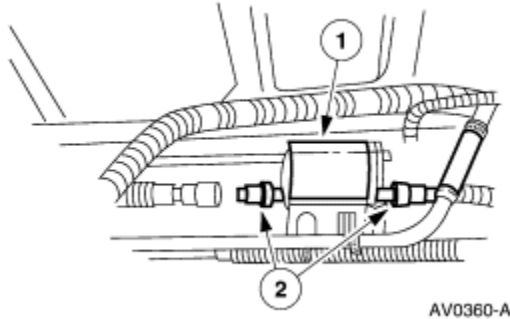
⚠ WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related component. Highly flammable mixtures are always present and may be ignited, resulting in possible personal injury.

1. Relieve the fuel system pressure; refer to [Section 310-00](#). Use the fuel line disconnect tool to disconnect the fuel lines from the fuel filter; refer to [Section 310-00](#).



Installation

1. When installing fuel lines to the fuel filter, push the lines onto the ports until a definite "click" is heard, then pull on the fittings to make sure they are engaged.
 1. Install the fuel filter.
 2. Connect the fuel lines.




SECTION 310-01: Fuel Tank and Lines
REMOVAL AND INSTALLATION

1999 F-Super Duty 250-550 Workshop Manual

[Procedure revision date: 11/20/2002](#)

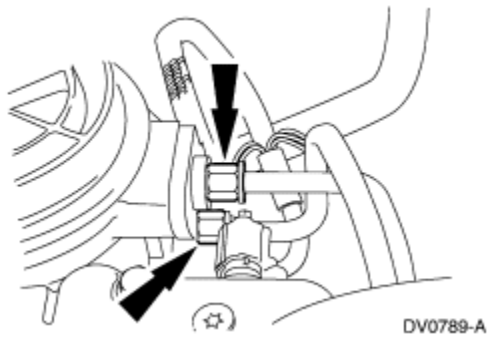
Filter—Water Separator

Removal

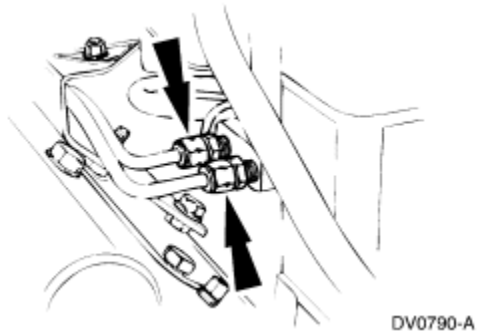
 **WARNING:** Smoking or open flame of any type must not be present when working near fuel or fuel vapor.

 **CAUTION:** The fuel system contains pressurized fuel after the vehicle is shut down and will maintain this pressure for a long period of time.

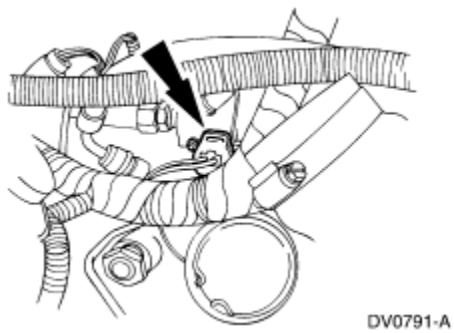
1. Disconnect both battery ground cables. On vehicles equipped with dual batteries, refer to [Section 414-01](#).
2. Open the fuel filter/water separator drain valve to release the fuel pressure. Completely drain the fuel filter/water separator assembly.
3. Disconnect the fuel supply and fuel return lines.



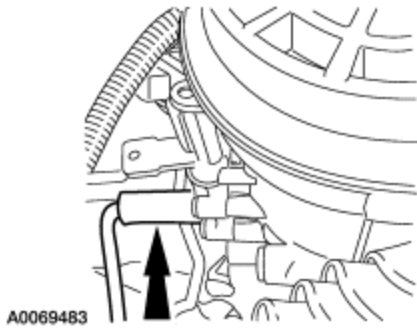
4. Disconnect the two cylinder head fuel supply lines.



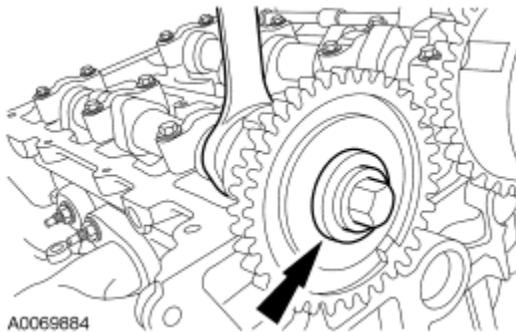
5. **NOTE:** The turbocharger compressor manifold is removed for clarity.
Disconnect the electrical connector from the fuel filter/water separator.




6. Disconnect the fuel drain tube.



7. Remove the fuel filter/water separator from the vehicle.
 1. Disconnect the exhaust back pressure sensor electrical connector.
 2. Remove the fuel filter/water separator retaining bolts.



Installation

1.  **WARNING:** Clean all the fuel residue from the engine compartment. Failure to do so can cause personal injury or damage to the vehicle.

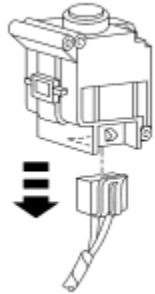
Follow the removal procedure in reverse order.

Inertia Fuel Shutoff (IFS) Switch

Removal

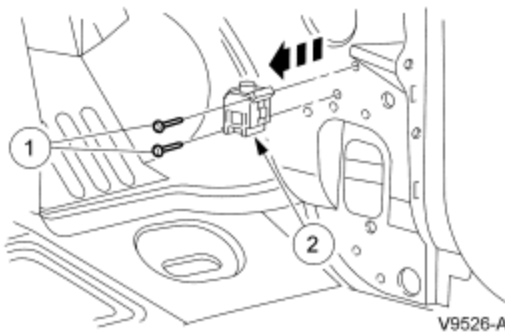
1. Disconnect the battery ground cable.

2. Remove the RH cowl side trim panel; refer to [Section 501-05](#). On motorhome chassis, the inertia fuel shutoff (IFS) switch is located near the engine cover under the dash, above the accelerator pedal.
3. Disconnect the electrical connector.



V9525-A

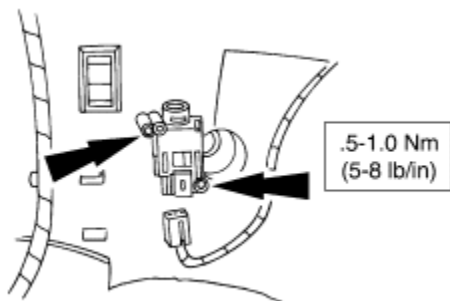
4. Remove the inertia fuel shutoff switch.
 1. Remove the bolts.
 2. Remove the inertia fuel shutoff switch.



V9526-A

Installation

1. Follow the removal procedure in reverse order.



AV0169-A

SECTION 310-02: Acceleration Control

SPECIFICATIONS

DESCRIPTION AND OPERATION

[Acceleration Control](#)

DIAGNOSIS AND TESTING

[Acceleration Control](#)

[Inspection and Verification](#)

[Symptom Chart](#)

REMOVAL AND INSTALLATION

[Pedal—Accelerator, Gasoline Engine](#)

[Pedal—Accelerator and Sensor Assembly, Diesel Engine](#)

[Cable—Accelerator](#)

[Cable Bracket—Accelerator](#)

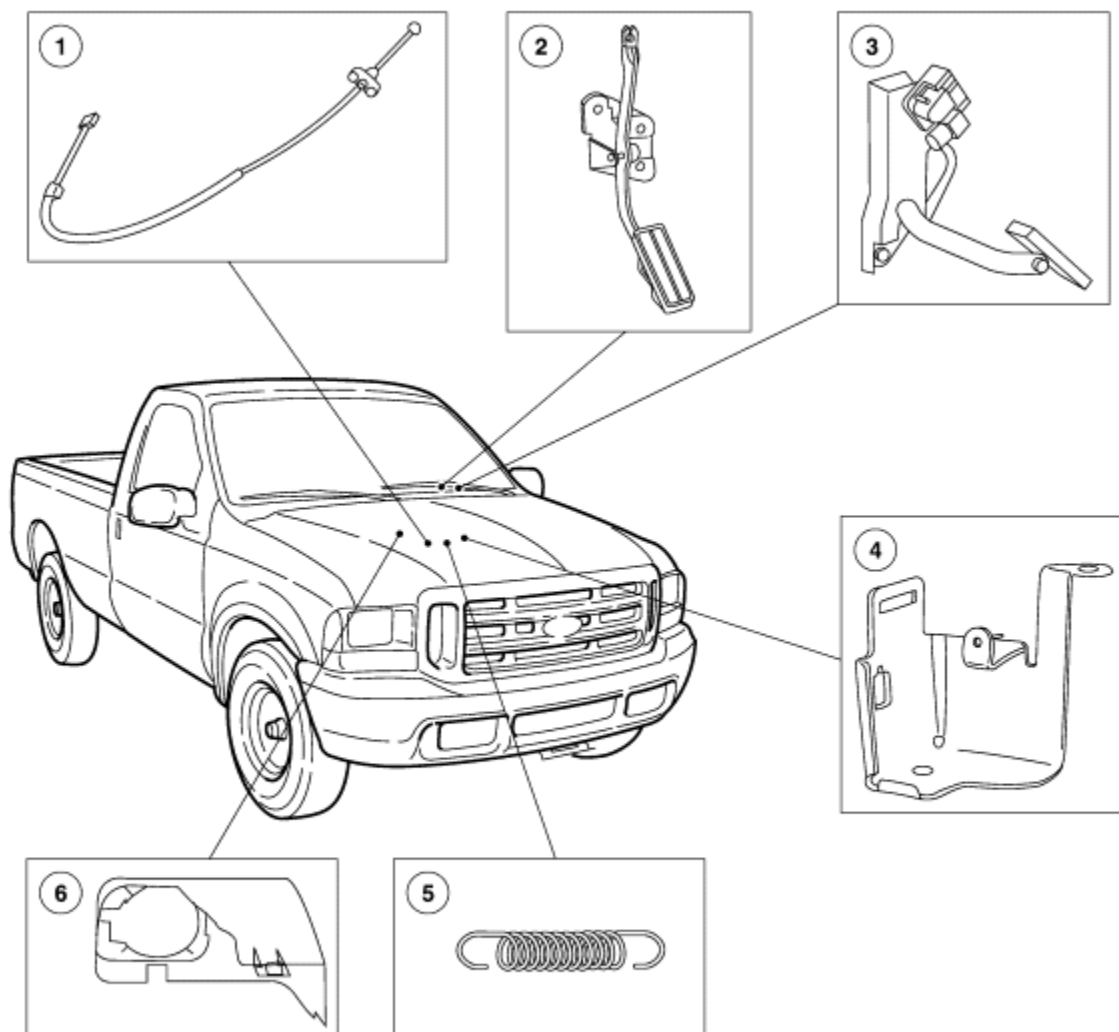
SECTION 310-02: Acceleration Control SPECIFICATIONS

1999 F-Super Duty 250-550 Workshop Manual
[Procedure revision date: 01/26/2000](#)

Torque Specifications			
Description	Nm	Lb/Ft	Lb/In
Accelerator Pedal and Shaft Bolts (Gasoline)	22-28	17-20	—
Accelerator Pedal and Sensor Assembly Bolts (7.3L Diesel)	22-28	17-20	—
Accelerator Cable Bracket Bolts	9-12	—	80-106
Throttle Body Inlet Air Duct Screw Clamp	3-5	—	27-44
Accelerator Cable Bulkhead Retaining Bolts	2-4	—	18-35

Acceleration Control

Component Location



AV1085-B

Item	Part Number	Description
1	9A758	Accelerator Cable
2	9725	Accelerator Pedal and Shaft
3	9F836	Accelerator Pedal and Sensor Assembly (7.3L Diesel Engine)

4	9728	Accelerator Cable Bracket (Gasoline Engines)
5	9E894	Secondary Return Spring
6	9E766	Accelerator Control Splash Shield

The throttle is controlled by an accelerator cable attached to the accelerator pedal and shaft. The accelerator pedal and shaft should travel smoothly from the idle to the wide open throttle positions. Hesitation on return or prevention of return to the idle position must not occur. Surrounding components such as wiring, hoses, sound insulator and floor carpet must not contact the sliding inner member of the accelerator cable or the accelerator pedal and shaft. The throttle assembly is not adjustable.

The 7.3L diesel engine does not use an accelerator cable. Instead, the 7.3L diesel engine uses an accelerator sensor assembly located on the accelerator pedal assembly. This drive by wire system is entirely electronic, and except for the accelerator pedal assembly, does not use mechanically moving parts. The accelerator sensor assembly is not adjustable.

SECTION 310-02: Acceleration Control
DIAGNOSIS AND TESTING

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Acceleration Control

Inspection and Verification

1. Verify the customer's concern by operating the acceleration control system to duplicate the condition.
2. Inspect to determine if any of the following mechanical concerns apply.

Visual Inspection Chart	
Mechanical	
•	Damaged accelerator pedal and shaft.
•	Damaged linkage.
•	Damaged accelerator cable.
•	High engine idle speed.
•	Damaged throttle body.

3. If the inspection reveals an obvious concern that can be readily identified, repair it as required.
4. If the concern remains after the inspection, determine the symptoms and go to the Symptom Chart.

Symptom Chart

SYMPTOM CHART		
Condition	Possible Sources	Action
<ul style="list-style-type: none"> Excessive Effort Is Needed to Depress the Accelerator Pedal and Shaft 	<ul style="list-style-type: none"> Worn accelerator lever pivot bushing. 	<ul style="list-style-type: none"> REPLACE the accelerator pedal and shaft.
	<ul style="list-style-type: none"> The accelerator cable is binding. 	<ul style="list-style-type: none"> REPLACE the accelerator cable.
	<ul style="list-style-type: none"> Worn or damaged throttle body. 	<ul style="list-style-type: none"> REPLACE the throttle body; REFER to Section 303-04A (5.4L), Section 303-04B (6.8L).
<ul style="list-style-type: none"> The Accelerator Pedal and Shaft Feels Rough or Raspy 	<ul style="list-style-type: none"> Frayed or binding accelerator cable. 	<ul style="list-style-type: none"> REPLACE the accelerator cable.
	<ul style="list-style-type: none"> Worn or damaged throttle body. 	<ul style="list-style-type: none"> REPLACE the throttle body; REFER to Section 303-04A (5.4L), Section 303-04B (6.8L).
<ul style="list-style-type: none"> The Accelerator Pedal and Shaft Is Binding or Sticking 	<ul style="list-style-type: none"> Kinked accelerator cable. 	<ul style="list-style-type: none"> REPLACE the accelerator cable.
	<ul style="list-style-type: none"> Foreign object caught in the accelerator pedal 	<ul style="list-style-type: none"> CHECK the accelerator pedal linkage.

	linkage.	
	<ul style="list-style-type: none"> Worn or damaged throttle body. 	<ul style="list-style-type: none"> REPLACE the throttle body; REFER to Section 303-04A (5.4L), Section 303-04B (6.8L).
<ul style="list-style-type: none"> High Engine Idle Speed 	<ul style="list-style-type: none"> Kinked accelerator cable. 	<ul style="list-style-type: none"> REPLACE the accelerator cable.
	<ul style="list-style-type: none"> Foreign object caught in the accelerator pedal linkage. 	<ul style="list-style-type: none"> CHECK the accelerator pedal linkage.
	<ul style="list-style-type: none"> Incorrect engine idle speed. 	<ul style="list-style-type: none"> REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the idle control system.
<ul style="list-style-type: none"> Irregular Engine Idle Speed (Diesel) 	<ul style="list-style-type: none"> Incorrect engine idle speed adjustment or idle validation switch. 	<ul style="list-style-type: none"> REPLACE the accelerator pedal and sensor assembly.

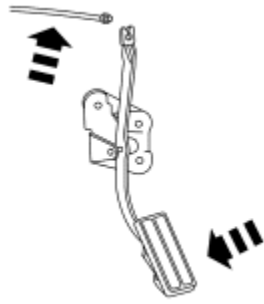
SECTION 310-02: Acceleration Control
REMOVAL AND INSTALLATION

1999 F-Super Duty 250-550 Workshop Manual
[Procedure revision date: 01/26/2000](#)

Pedal—Accelerator, Gasoline Engine

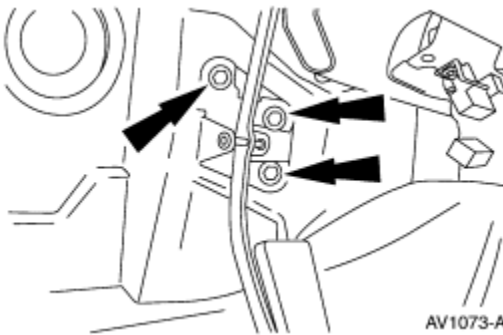
Removal

1. Hold the pedal in place and disconnect the accelerator cable from the accelerator pedal and shaft.



AV1211-A

2. Remove the bolts.

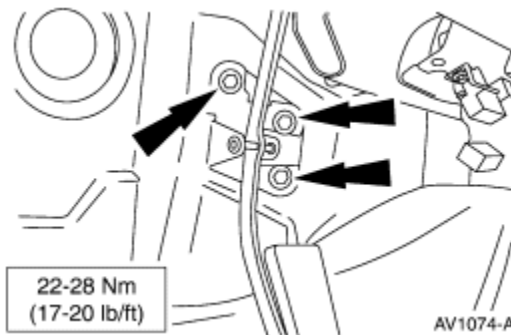


AV1073-A

3. Remove the accelerator pedal and shaft.

Installation


1. Follow the removal procedure in reverse order.



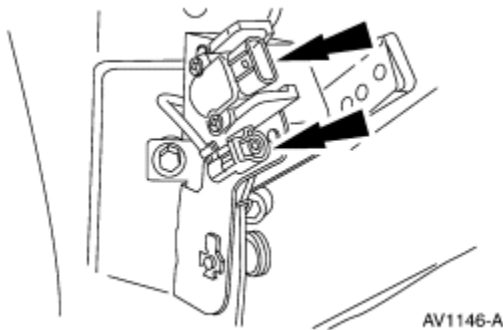
AV1074-A

Pedal—Accelerator and Sensor Assembly, Diesel Engine

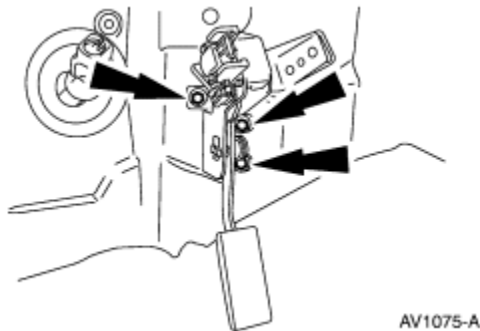
Removal

 **CAUTION:** The accelerator pedal and sensor assembly is a non-adjustable, calibrated unit and must be handled with care.

1. Disconnect the electrical connectors.

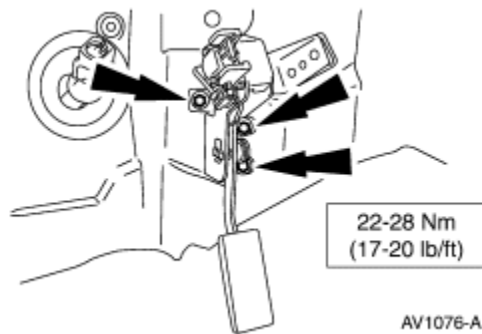


2. Remove the bolts and remove the accelerator pedal and sensor assembly.



Installation

1. Follow the removal procedure in reverse order.



SECTION 310-02: Acceleration Control
REMOVAL AND INSTALLATION

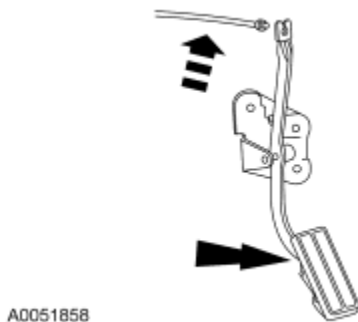
1999 F-Super Duty 250-550 Workshop Manual


[Procedure revision date: 03/18/2002](#)

Cable—Accelerator

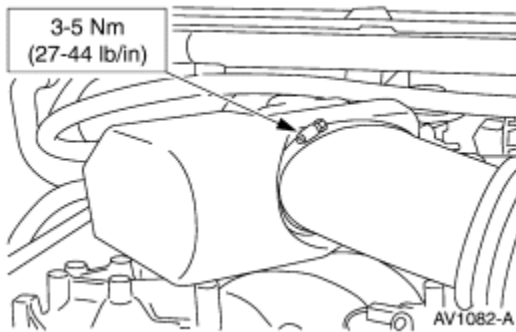
Removal and Installation

1. Hold the accelerator pedal in place and disconnect the accelerator cable from the accelerator pedal and shaft.



2.  **CAUTION:** The air cleaner outlet tube must be securely sealed to prevent unmetered air from entering the engine.

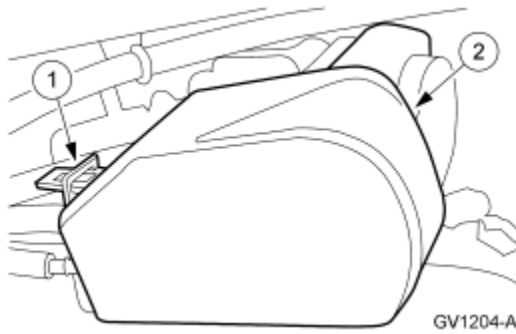
Disconnect the air cleaner outlet tube from the throttle body.



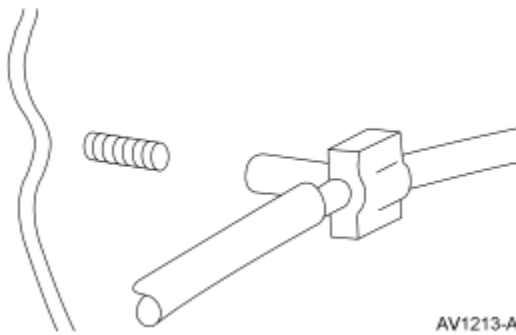
3. Remove the accelerator control splash shield.

1. Release the tab.

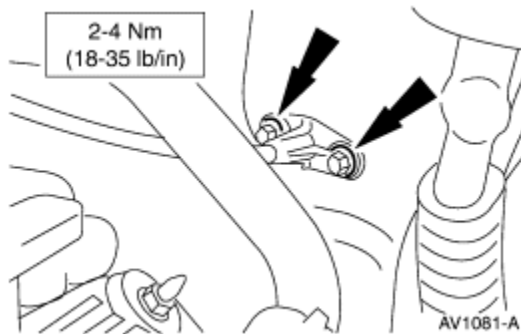
2. Remove the splash shield.



4. Disconnect the accelerator cable pushpin from the dash panel stud.



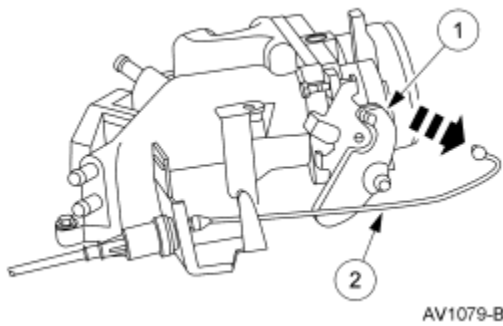
5. Remove the bolts and pull the cable through the bulkhead.



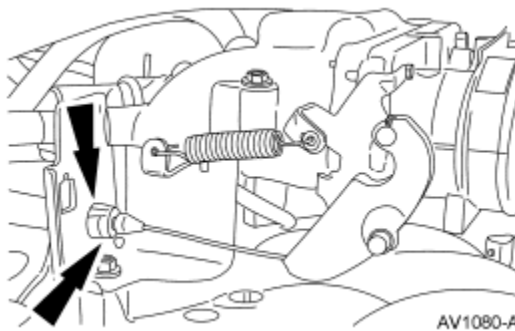
6. Disconnect the accelerator cable from the throttle body lever.

1. Rotate the throttle body lever forward.

2. Disconnect the accelerator cable.



7. Depress the locking tabs and remove the accelerator cable.




8. Remove the accelerator cable from the vehicle.

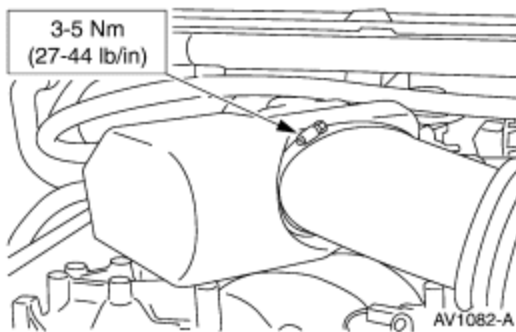
9. To install, reverse the removal procedure.

Cable Bracket—Accelerator

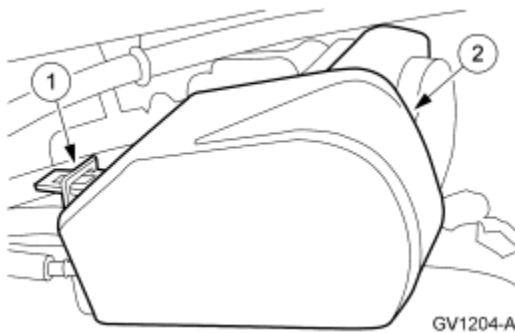
Removal and Installation

1.  **CAUTION:** The air cleaner outlet tube must be securely sealed to prevent unmetered air from entering the engine.

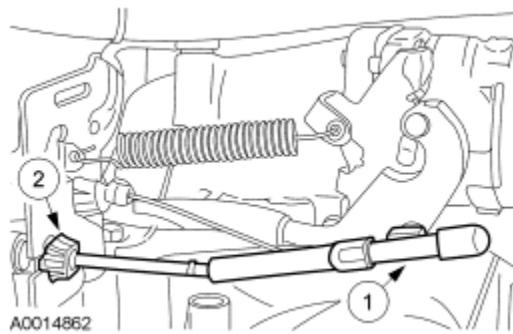
Disconnect the air cleaner outlet tube from the throttle body.



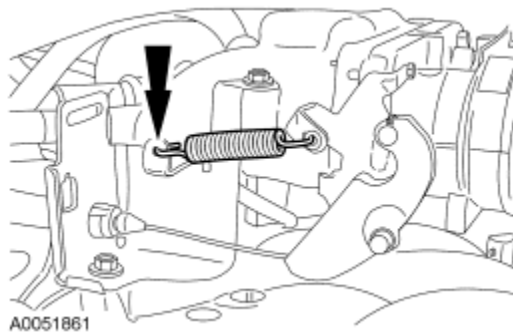
2. Remove the accelerator control splash shield.
 1. Remove the tab.
 2. Remove the accelerator control splash shield.



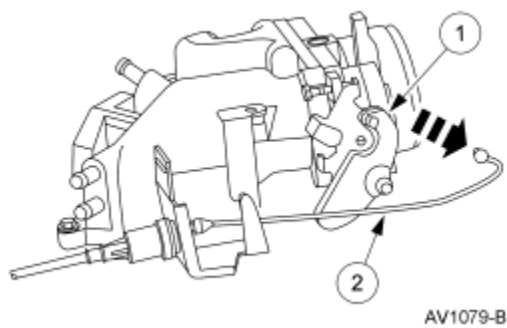
3. Disconnect the speed control cable.
 1. Disconnect the speed control cable from the throttle body cam and position aside.
 2. Depress the retaining clips to remove the cable from the bracket.



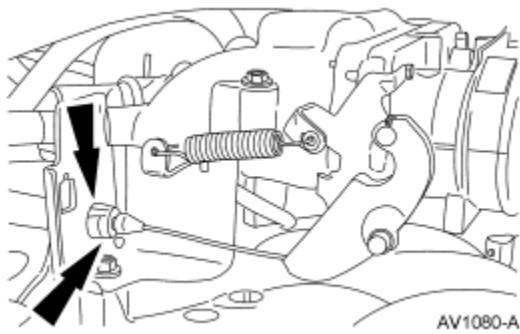
4. Disconnect the throttle return spring.



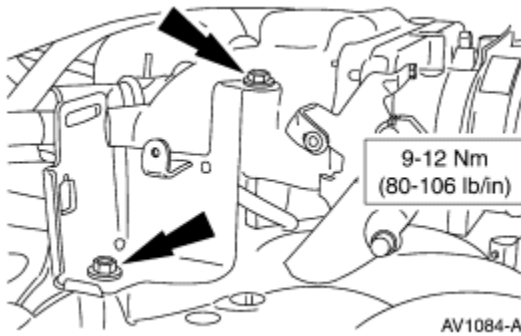
5. Disconnect the accelerator cable from the throttle body lever.
 1. Rotate the throttle body lever.
 2. Disconnect the accelerator cable.



6. Depress the locking tabs and remove the accelerator cable.



7. Remove the bolts and remove the accelerator cable bracket.



8. To install, reverse the removal procedure.
-

SECTION 310-03: Vehicle Speed Control

[SPECIFICATIONS](#)

DESCRIPTION AND OPERATION

[Speed Control](#)

DIAGNOSIS AND TESTING

[Speed Control](#)

[Inspection and Verification](#)

[Symptom Chart](#)

[Pinpoint Tests](#)

REMOVAL AND INSTALLATION

[Actuator Cable—Speed Control](#)

[Actuator—Speed Control Servo](#)

[Switch—Speed Control Actuator](#)

[Switch—Deactivator](#)

[Brush Assembly](#)

[Brush Assembly—Control and Spring](#)

SECTION 310-03: Vehicle Speed Control SPECIFICATIONS

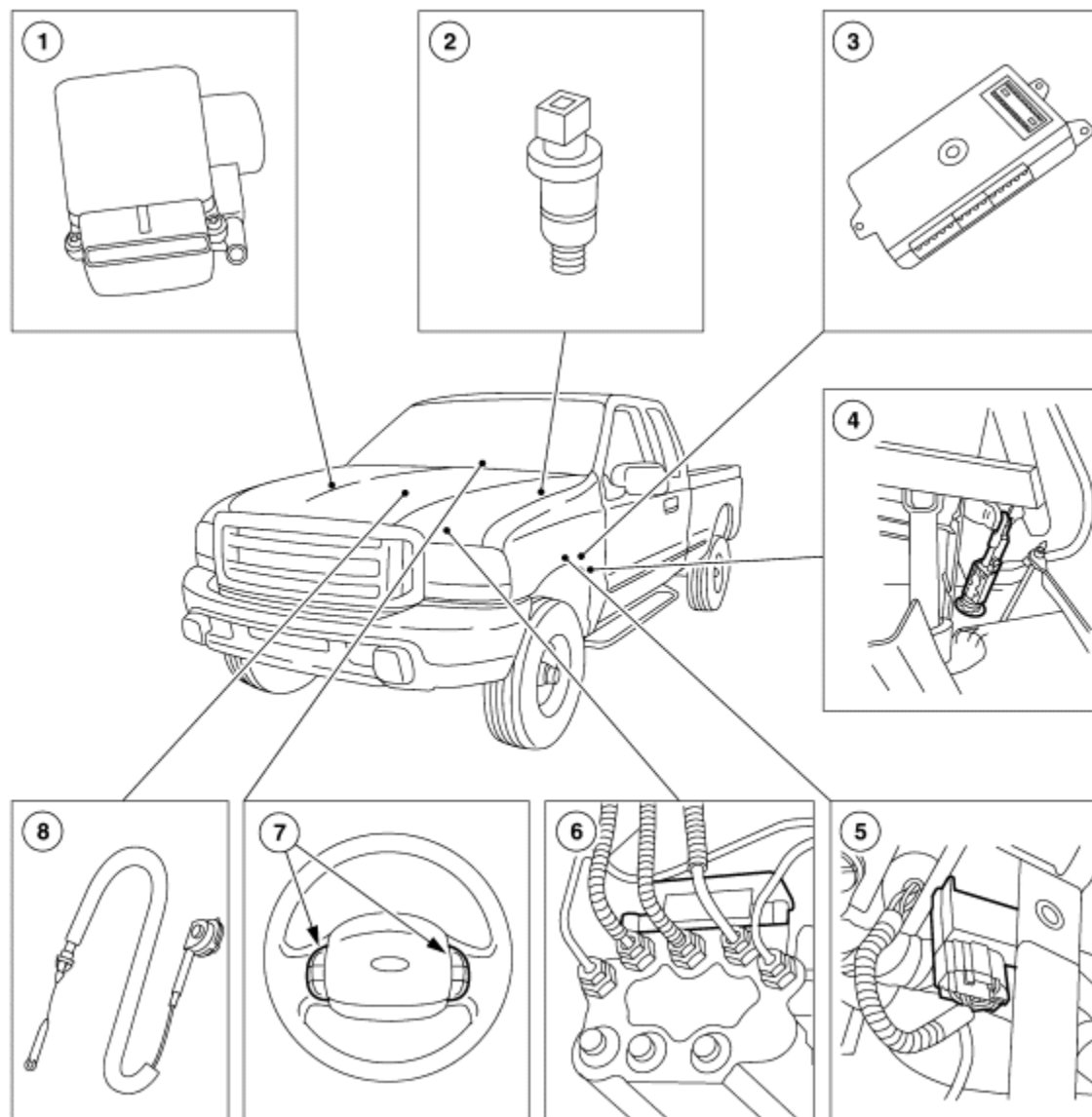
1999 F-Super Duty 250-550 Workshop Manual

[Procedure revision date: 01/26/2000](#)

Torque Specifications			
Description	Nm	Lb/Ft	Lb/In
Accelerator Control Splash Shield Bolts (5.4L)	3.1-4.3	—	28-38
Brush Assembly Screw	2.5	—	22
Control and Spring Retaining Screws	1	—	9
Deactivator Switch	15-20	11-15	—
Speed Control Servo Bracket to Vehicle Bolts	8-10	—	72-89
Speed Control Servo Bracket to Speed Control Servo	8-10	—	72-89

Speed Control

Vehicle Speed Control Components



GV1217-A

Item	Part Number	Description
1	9C735	Speed Control Servo
2	9F924	Deactivator Switch
3	—	GEM/CTM
4	7641	Clutch Pedal Position (CPP) Switch

5	13480	Brake Pedal Position (BPP) Switch
6	2B373	Anti-Lock Brake Control Module
7	9C888	Speed Control Actuator Switches
8	9A825	Speed Control Actuator Cable

The speed control system is designed to maintain vehicle speed above 48 km/h (30 mph). After the ON switch is depressed, depressing the SET/ACCEL switch will activate the speed control servo. To increase a set speed, either depress and hold for continuous acceleration, or momentarily tap the SET/ACCEL switch for 1.6 km/h (1 mph) acceleration increments. To decrease a set speed, depress and hold the COAST switch until the target speed is reached, or momentarily tap the COAST switch for 1.6 km/h (1 mph) deceleration increments. When the speed control system has been disabled by tapping the brake pedal, the RESUME switch can be depressed and the vehicle will return to the original set speed if the vehicle is traveling over 48 km/h (30 mph) and the OFF switch has not been depressed.

NOTE: The clutch pedal position (CPP) switch or jumper is replaced with the clutch master cylinder push rod.

NOTE: The deactivator switch is provided as an additional safety feature. Normally, when the brake pedal is depressed, an electrical signal from the brake lamp circuit to the speed control servo will deactivate the system. Under increased brake pedal effort, the deactivator switch will open and remove power to the speed control servo, releasing the throttle independent of the speed control servo.

NOTE: The air bag sliding contact (motorhome, control and spring brush assembly) provides the electrical interface between the steering column wiring and the speed control actuator switches in the steering wheel.

The inputs to the speed control servo are:


- Vehicle speed signal from the anti-lock brake control module.
- Speed control actuator switches.
- Brake pedal position (BPP) switch.
- CPP switch or jumper.
- Deactivator switch.

The outputs of the speed control servo are:

- Speed control actuator cable controlling the throttle position.
-

Speed Control

Refer to Wiring Diagrams Cell 31 ([F-53 Motorhome Chassis](#), [F-Super Duty 250-550](#)), Speed Control for schematic and connector information.

Special Tool(s)	
 ST1137-A	73 Digital Multimeter or equivalent 105-R0051

Inspection and Verification

NOTE: If any concerns are noted with the speedometer or horn, address those concerns by referring to their associated sections before continuing speed control diagnosis.

NOTE: When in speed control mode, initial depression of the clutch pedal may cause a normal momentary increase of engine rpm.

1. Verify the customer concern by operating the speed control system.
2. Visually inspect for obvious signs of mechanical and electrical damage.

Visual Inspection Chart	
Mechanical	Electrical
<ul style="list-style-type: none">• Damaged speed control actuator cable• Speed control actuator cable not attached to throttle	<ul style="list-style-type: none">• Fuse(s)• Damaged wiring• Loose, corroded, or dirty connections• Damaged speed control actuator switches

3. If the fault is not visually evident, verify the symptom and refer to Symptom Chart.

Symptom Chart


NOTE: New speed control diagnostic software is available in version 12 or higher for New Generation STAR (NGS) Tester 418-F048 (007-00500). When using this software, it is necessary to use NGS Electronic Speed Control Interface Cable Kit 007-00586 with NGS Tester.

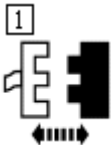

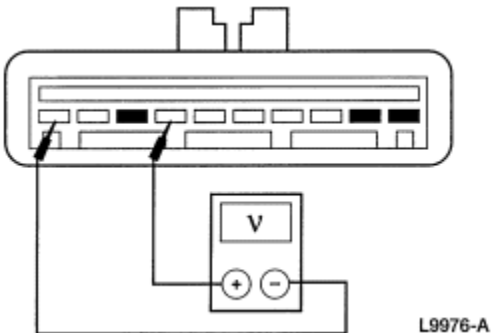
Symptom Chart		
Condition	Possible Sources	Action
<ul style="list-style-type: none">The Speed Control Is Inoperative	<ul style="list-style-type: none">Actuator cable not attached to throttle.Fuse.Circuitry.Deactivator switch.Brake pedal position (BPP) switch.Speed control actuator switch (9C888).GEM/CTM (if equipped with RABS) or anti-lock brake control module (if equipped with 4WABS).Speed control servo (9C735).Clutch pedal position (CPP) switch or jumper.	<ul style="list-style-type: none">GO to Pinpoint Test A.
<ul style="list-style-type: none">The Set Speed Fluctuates	<ul style="list-style-type: none">Speed control servo.Speed control actuator switch.Circuitry.Loose fit or binding between speed control actuator cable and throttle body.	<ul style="list-style-type: none">GO to Pinpoint Test B.
	<ul style="list-style-type: none">Engine controls.	<ul style="list-style-type: none">Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual. REPAIR engine as required.
<ul style="list-style-type: none">The Speed Control Does Not Disengage When the Brakes Are	<ul style="list-style-type: none">Brake pedal position (BPP) switch.Deactivator switch.Speed control servo.Fuse.	<ul style="list-style-type: none">GO to Pinpoint Test C.

Applied	<ul style="list-style-type: none"> • Circuitry. • Binding speed control actuator cable. • Clutch pedal position (CPP) switch or jumper. 	
<ul style="list-style-type: none"> • The Speed Control Does Not Disengage When the Clutch Is Applied 	<ul style="list-style-type: none"> • Clutch pedal position (CPP) switch. • Circuitry. • Speed control servo. 	<ul style="list-style-type: none"> • GO to Pinpoint Test D.
<ul style="list-style-type: none"> • The Coast Switch Is Inoperative 	<ul style="list-style-type: none"> • Speed control actuator switch. • Speed control servo. 	<ul style="list-style-type: none"> • GO to Pinpoint Test E.
<ul style="list-style-type: none"> • The SET/ACCL Switch Is Inoperative 	<ul style="list-style-type: none"> • Speed control actuator switch. • Speed control servo. 	<ul style="list-style-type: none"> • GO to Pinpoint Test F.
<ul style="list-style-type: none"> • The Resume Switch Is Inoperative 	<ul style="list-style-type: none"> • Speed control actuator switch. • Speed control servo. 	<ul style="list-style-type: none"> • GO to Pinpoint Test G.
<ul style="list-style-type: none"> • The OFF Switch Is Inoperative 	<ul style="list-style-type: none"> • Speed control actuator switch. • Speed control servo. 	<ul style="list-style-type: none"> • GO to Pinpoint Test H.

Pinpoint Tests

PINPOINT TEST A: THE SPEED CONTROL IS INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1 CHECK THE SPEED CONTROL ACTUATOR ATTACHMENT TO THROTTLE	
<div>1</div> 	
	<div>2</div> Remove the accelerator control splash shield.

	<p>Inspect the speed control actuator cable attachment. Check the speed control actuator cable by pulling on the cable and noting the throttle movement.</p>
	<ul style="list-style-type: none"> • Is the speed control actuator cable OK? <p>→ Yes GO to A2 .</p> <p>→ No REPAIR/REATTACH the speed control actuator cable. TEST the system for normal operation.</p>
A2 CHECK THE VOLTAGE TO THE SPEED CONTROL SERVO	
<p>1</p>  <p>Speed Control Servo C1067 (Motorhome C146)</p>	
<p>2</p> 	
<p>3</p> 	<p>3 Measure the voltage between speed control servo C1067-7 (motorhome C146-7), circuit 295 (LB/PK), and speed control servo C1067-10 (motorhome C146-10), circuit 57 (BK).</p>
	<ul style="list-style-type: none"> • Is the voltage greater than 10 volts? <p>→ Yes GO to A5.</p> <p>→ No GO to A3.</p>

A3 CHECK FUSE JUNCTION PANEL FUSE 28 (10A) (MOTORHOME FUSE 26 [10A])

1



2



Fuse Junction Panel Fuse 28 (10A)
(Motorhome Fuse 26 [10A])

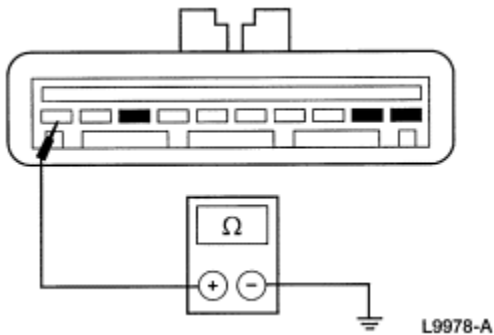
- **Is the fuse OK?**

→ **Yes**
GO to [A4](#).

→ **No**
REPLACE the fuse. TEST the system for normal operation. If the fuse fails again, CHECK for short to ground. REPAIR as necessary. TEST the system for normal operation.

A4 CHECK THE SPEED CONTROL SERVO GROUND CIRCUIT 57 (BK)

1


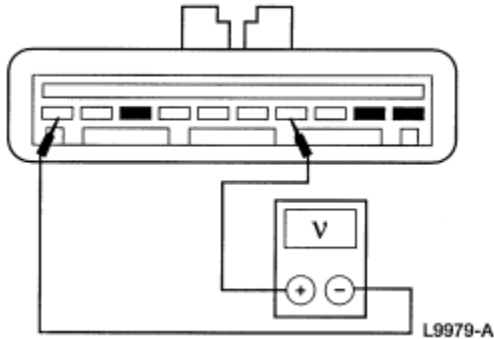
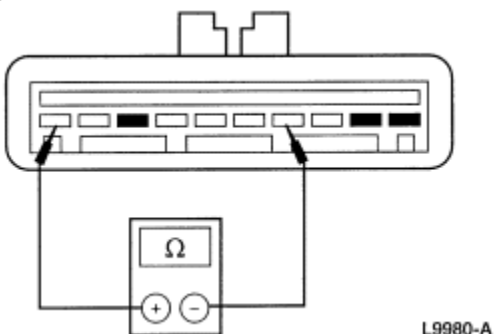


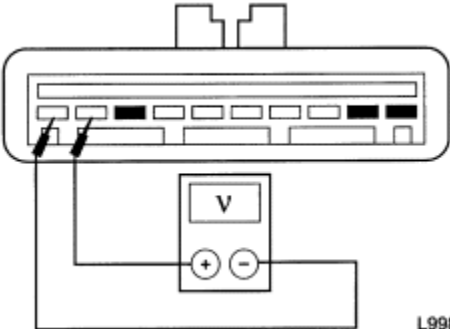

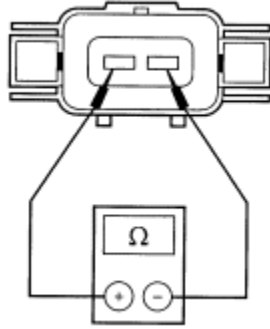
1 Measure the resistance between speed control servo C1067-10 (motorhome C146-10), circuit 57 (BK), and ground.

- **Is the resistance less than 5 ohms?**

→ **Yes**
REPAIR circuit 295 (LB/PK). TEST the system for normal operation.

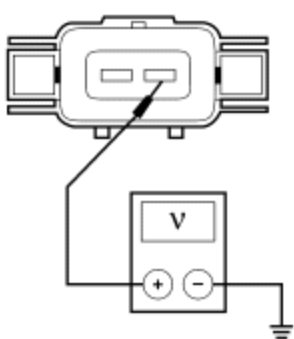
→ **No**
REPAIR circuit 57 (BK). TEST the system for

	normal operation.
A5 CHECK FOR BRAKE PEDAL POSITION (BPP) SWITCH INPUT WITH NO BRAKES APPLIED	
<div data-bbox="168 289 201 323" data-label="Text">1</div> 	
<div data-bbox="168 457 201 491" data-label="Text">2</div> 	<div data-bbox="750 457 782 491" data-label="Text">2</div> <p>Measure the voltage between speed control servo C1067-4, circuit 306 (T/LB) (motorhome C146-4, circuit 810 [R/LG]), and speed control servo C1067-10 (motorhome C146-10), circuit 57 (BK).</p>
	<ul style="list-style-type: none"> Is voltage present? <p>→ Yes REPLACE the BPP switch; REFER to Section 417-01. TEST the system for normal operation.</p> <p>→ No GO to A6.</p>
A6 CHECK THE BRAKE/CLUTCH CIRCUIT	
<div data-bbox="168 1289 201 1323" data-label="Text">1</div> 	<div data-bbox="750 1289 782 1323" data-label="Text">1</div> <p>Measure the resistance between speed control servo C1067-4, circuit 306 (T/LB) (motorhome C146-4, circuit 810 [R/LG]), and speed control servo C1067-10 (motorhome C146-10), circuit 57 (BK).</p>
	<ul style="list-style-type: none"> Is the resistance less than 5 ohms? <p>→ Yes GO to A7.</p>

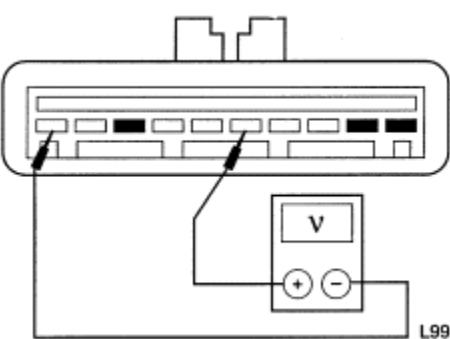
	<p>→ No GO to A16.</p>
A7 CHECK THE DEACTIVATOR SWITCH INPUT TO SPEED CONTROL SERVO	
<p>1</p>  <p>L9981-A</p>	<p>1 Measure the voltage between speed control servo C1067-9 (motorhome C146-9), circuit 307 (BK/Y), and speed control servo C1067-10 (motorhome C146-10), circuit 57 (BK).</p>
	<ul style="list-style-type: none"> • Is the voltage greater than 10 volts? <p>→ Yes GO to A10.</p> <p>→ No GO to A8.</p>
A8 CHECK THE DEACTIVATOR SWITCH CIRCUIT	
<p>1</p>  <p>Deactivator Switch C102 (Motorhome C125)</p>	
<p>2</p>  <p>L9982-A</p>	<p>2 Measure the resistance between the deactivator switch terminals (component side).</p>

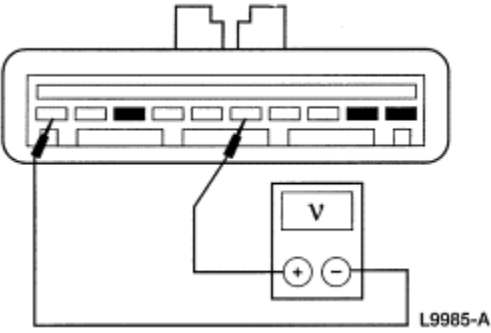

	<ul style="list-style-type: none"> • Is the resistance less than 5 ohms? <p>→ Yes GO to A9.</p> <p>→ No REPLACE the deactivator switch; REFER to Switch—Deactivator. TEST the system for normal operation.</p>
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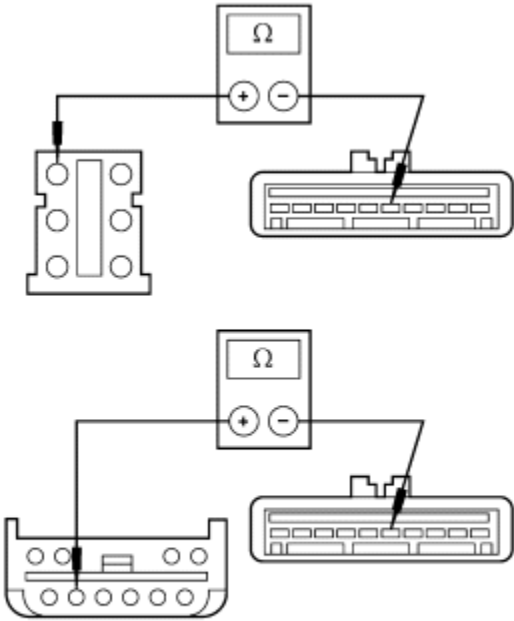
A9 CHECK DEACTIVATOR SWITCH POWER

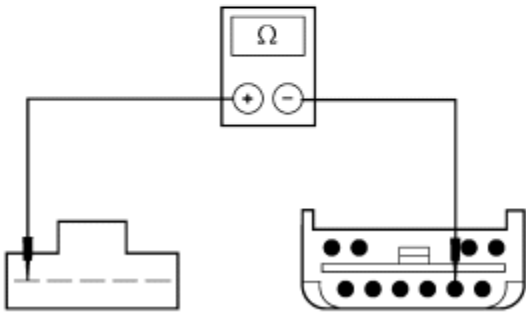
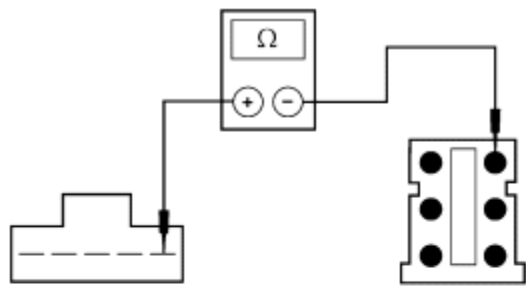
<p>1</p>  <p>L9983-A</p>	<p>1 Measure the voltage between deactivator switch C102 (motorhome C125), circuit 10 (LG/R), and ground.</p>
	<ul style="list-style-type: none"> • Is the voltage greater than 10 volts? <p>→ Yes REPAIR circuit 307 (BK/Y). TEST the system for normal operation.</p> <p>→ No REPAIR circuit 10 (LG/R) and/or fuse 13 (20A) (motorhome fuse 8 [10A]). TEST the system for normal operation.</p>

A10 CHECK FOR STUCK SPEED CONTROL ACTUATOR SWITCH

<p>1</p>  <p>L9985-A</p>	<p>1 Measure the voltage between speed control servo C1067-5 (motorhome C146-5), circuit 151 (LB/BK), and speed control servo C1067-10 (motorhome C146-10), circuit 57 (BK).</p>

	<ul style="list-style-type: none"> • Is voltage present? <p>→ Yes GO to A17.</p> <p>→ No GO to A11.</p>
A11 CHECK THE SPEED CONTROL ACTUATOR SWITCH OPERATION	
<p>1</p> 	<p>1 With the speed control actuator switch depressed to the ON position, measure the voltage between speed control servo C1067-5 (motorhome C146-5), circuit 151 (LB/BK), and speed control servo C1067-10 (motorhome C146-10), circuit 57 (BK).</p>
	<ul style="list-style-type: none"> • Is the voltage greater than 10 volts? <p>→ Yes GO to A14.</p> <p>→ No GO to A12.</p>
A12 CHECK CIRCUIT 151 (LB/BK) FOR AN OPEN	
<p>1</p>  <p>Air Bag Sliding Contact C219 or Control and Brush Assembly C222</p>	
<p>2</p>	<p>2 Measure the resistance between speed control servo C1067-6 (motorhome C146-6), circuit 151 (LB/BK), and air bag sliding contact C219F-1, circuit 151 (LB/BK) (6 pin) or control and spring brush assembly C222F-5, circuit 151 (LB/BK) (10 pin).</p>

 <p>GV1215-A</p>	
	<ul style="list-style-type: none"> • Is the resistance less than 5 ohms? <p>→ Yes GO to A13.</p> <p>→ No REPAIR circuit 151 (LB/BK). TEST the system for normal operation.</p>
A13 CHECK THE AIR BAG SLIDING CONTACT OR CONTROL AND BRUSH ASSEMBLY FOR AN OPEN	
	<ol style="list-style-type: none"> 1 Remove the driver side air bag (if equipped); refer to Section 501-20B.
<ol style="list-style-type: none"> 2 	<ol style="list-style-type: none"> 2 Measure the resistance between air bag sliding contact C219M-1, and top of air bag sliding contact terminal 5 (6 pin) or between control and spring brush assembly C222M-5, and top of control and spring brush assembly terminal 1 (10 pin).



GV1216-A

- Is the resistance less than 1 ohm?

→ **Yes**

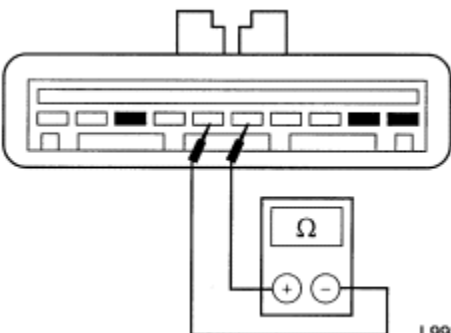
REPLACE the speed control actuator switch;
REFER to [Switch—Speed Control Actuator](#). TEST
the system for normal operation.

→ **No**

REPLACE the air bag sliding contact (14A664);
REFER to [Section 501-20B](#) or REPLACE the
control and spring brush assembly; REFER to
[Brush Assembly—Control and Spring](#). TEST the
system for normal operation.

A14 CHECK THE SET/ACCEL SWITCH


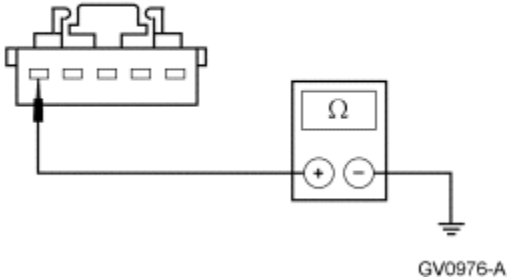
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L9987-A


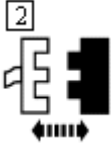

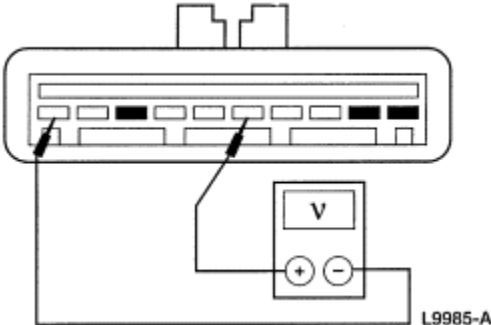
1




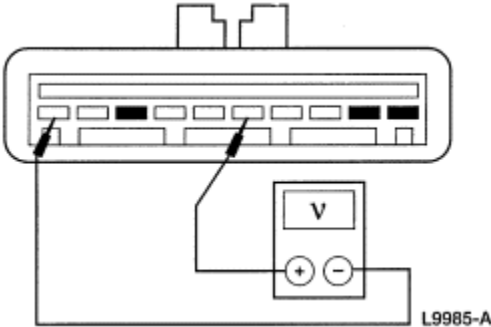
With the SET/ACCEL switch depressed,
measure the resistance between speed control servo
C1067-5 (motorhome C146-5), circuit 151
(LB/BK), and speed control servo C1067-6
(motorhome C146-6), circuit 848 (DG/O).

	<ul style="list-style-type: none"> Is the resistance between 612 and 748 ohms? <p>→ Yes GO to A15.</p> <p>→ No REPLACE the speed control actuator switch; REFER to Switch—Speed Control Actuator. TEST the system for normal operation.</p>
A15 CHECK THE SPEEDOMETER	
	<p>1 Check the speedometer for proper operation by driving the vehicle.</p>
	<ul style="list-style-type: none"> Does the speedometer operate properly? <p>→ Yes REPAIR circuit 679 (GY/BK). TEST the system for normal operation.</p> <p>→ No REFER to Section 413-01.</p>
A16 CHECK CIRCUIT 676 (PK/O) (MOTORHOME 1203 [BK/BL]) FOR AN OPEN	
<p>1</p>  <p>Brake Pedal Position (BPP) Switch C279 (Motorhome C231)</p>	
<p>2</p>  <p>GV0976-A</p>	<p>2 Measure the resistance between BPP switch C279-1, circuit 676 (PK/O) (motorhome C231-1, circuit 1203 [BK/BL]), and ground.</p>

	<ul style="list-style-type: none"> • Is the resistance less than 5 ohms? <p>→ Yes GO to A19.</p> <p>→ No REPAIR circuit 676 (PK/O) (motorhome 1203 [BK/BL]). TEST the system for normal operation.</p>
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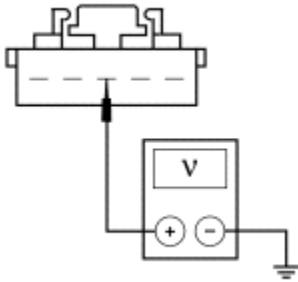
A17 CHECK THE SPEED CONTROL ACTUATOR SWITCH

<p>1</p> 	
<p>2</p>  <p>Speed Control Actuator Switches</p>	
<p>3</p> 	
<p>4</p> 	<p>4 Measure the voltage between speed control servo C1067-5 (motorhome C146-5), circuit 151 (LB/BK), and speed control servo C1067-10 (motorhome C146-10), circuit 57 (BK).</p>
	<ul style="list-style-type: none"> • Is voltage present? <p>→ Yes GO to A18.</p> <p>→ No REPLACE the speed control actuator switch; REFER to Switch—Speed Control Actuator. TEST</p>

	the system for normal operation.
A18 CHECK CIRCUIT 151 (LB/BK) FOR SHORT TO POWER	
<div>1</div> 	
<div>2</div>  <p>Air Bag Sliding Contact C219 or Control and Spring Brush Assembly C222</p>	
<div>3</div> 	
<div>4</div> 	<div>4</div> Measure the voltage between speed control servo C1067-5 (motorhome C146-5), circuit 151 (LB/BK), and speed control servo C1067-10 (motorhome C146-10), circuit 57 (BK).
	<ul style="list-style-type: none"> Is voltage present? <p>→ Yes REPLACE the air bag sliding contact; refer to Section 501-20B or REPLACE the control and spring brush assembly; REFER to Brush Assembly—Control and Spring. TEST the system for normal operation.</p> <p>→ No REPAIR circuit 151 (LB/BK). TEST the system for normal operation.</p>
A19 CHECK CIRCUIT 22 (LB/BK) FOR AN OPEN	
<div>1</div>	



2



GV1099-A

2 Measure the voltage between BPP switch C279-3 (motorhome C231-3), circuit 22 (LB/BK), and ground.

- Is the voltage greater than 10 volts?

→ Yes

If not motorhome, GO to [A20](#) .

If motorhome, REPAIR circuit 810 (R/LG). TEST the system for normal operation.

→ No

REPAIR circuit 22 (LB/BK). TEST the system for normal operation.

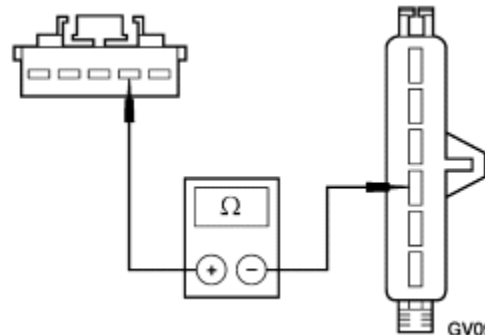
A20 CHECK CIRCUIT 810 (R/LG) FOR AN OPEN

1



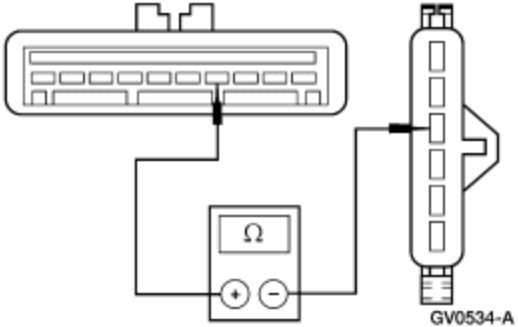
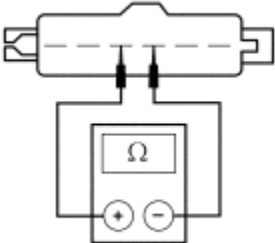
Clutch Pedal Position (CPP) Switch or Jumper C261

2




GV0904-A

2 Measure the resistance between BPP switch C279-2, circuit 810 (R/LG), and CPP switch or jumper C261-3, circuit (R/LG).


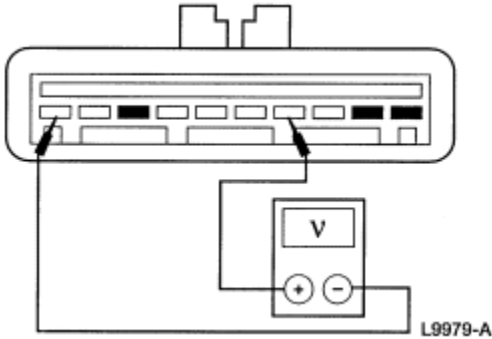
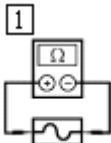
	<ul style="list-style-type: none"> • Is the resistance less than 5 ohms? <p>→ Yes GO to A21.</p> <p>→ No REPAIR circuit 810 (R/LG). TEST the system for normal operation.</p>
A21 CHECK CIRCUIT 306 (T/LB) FOR AN OPEN	
<p>1</p>  <p>GV0534-A</p>	<p>1 Measure the resistance between CPP switch or jumper C261-4, circuit 306 (T/LB), and speed control servo C1067-4, circuit 306 (T/LB).</p>
	<ul style="list-style-type: none"> • Is the resistance less than 5 ohms? <p>→ Yes GO to A22.</p> <p>→ No REPAIR circuit 306 (T/LB). TEST the system for normal operation.</p>
A22 CHECK THE CPP SWITCH	
<p>1</p>  <p>GV1098-A</p>	<p>1 Measure the resistance between CPP switch or jumper terminal 3, and terminal 4.</p>
	<ul style="list-style-type: none"> • Is the resistance less than 5 ohms?




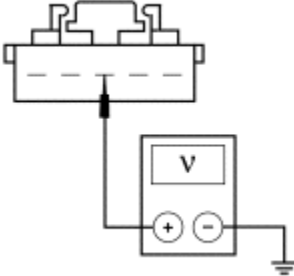
	<p>→ Yes REPLACE the BPP switch; refer to Section 417-01. TEST the system for normal operation.</p> <p>→ No REPLACE the CPP switch or jumper. TEST the system for normal operation.</p>
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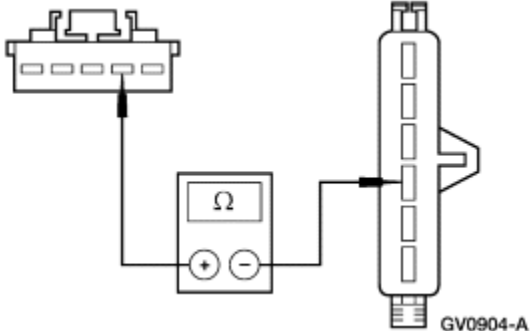
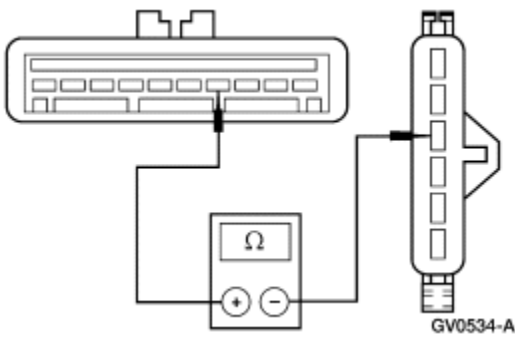
PINPOINT TEST B: THE SET SPEED FLUCTUATES

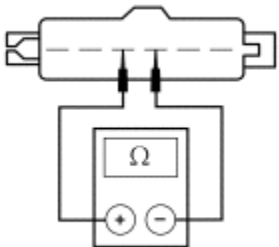
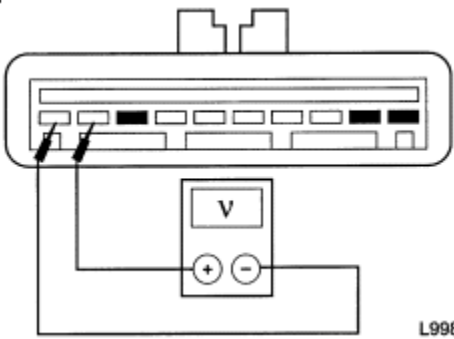
CONDITIONS	DETAILS/RESULTS/ACTIONS
B1 CHECK SPEED CONTROL ACTUATOR CABLE/THROTTLE BODY LINKAGE	
<div>1</div> 	
	<div>2</div> Remove the speed control actuator cable from the speed control servo. Visually inspect the core wire and check the speed control actuator cable by pulling on the cable and noting the throttle movement.
	<ul style="list-style-type: none"> Is the speed control actuator cable OK? <p>→ Yes GO to B2.</p> <p>→ No REPLACE the speed control actuator cable and/or REPAIR the throttle body linkage. REFER to Section 310-02. TEST the system for normal operation.</p>
B2 CHECK THE SPEEDOMETER	
	<div>1</div> Check the speedometer for proper operation by driving the vehicle.
	<ul style="list-style-type: none"> Does the speedometer fluctuate? <p>→ Yes REFER to Section 413-01.</p> <p>→ No REPLACE the speed control servo; REFER to Actuator—Speed Control Servo. TEST the system for normal operation.</p>


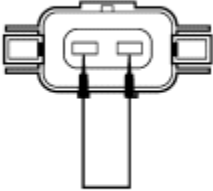
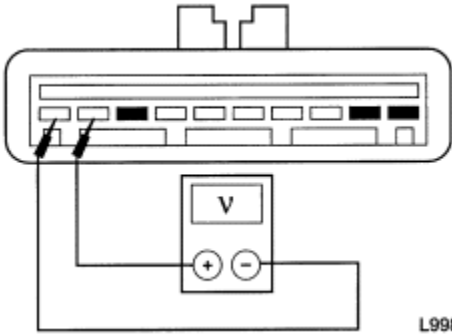
PINPOINT TEST C: THE SPEED CONTROL DOES NOT DISENGAGE WHEN THE BRAKES ARE APPLIED

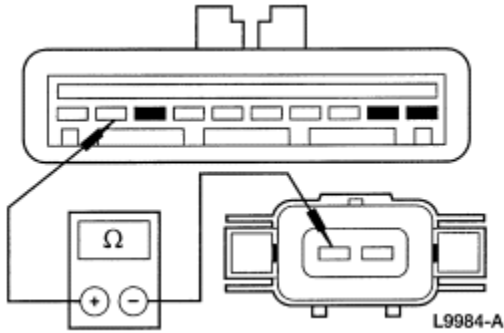
CONDITIONS	DETAILS/RESULTS/ACTIONS
C1 CHECK THE BRAKE PEDAL POSITION (BPP) SWITCH OPERATION	
<p>1</p>  <p>Speed Control Servo C1067 (Motorhome C146)</p>	
<p>2</p> 	<p>2 Measure the voltage between speed control servo C1067-4, circuit 306 (T/LB) (motorhome C146-4, circuit 810 [R/LG]), and speed control servo C1067-10 (motorhome C146-10), circuit 57 (BK), while pressing and releasing the brake pedal.</p>
	<ul style="list-style-type: none"> Is the voltage greater than 10 volts with the brake pedal pressed and 0 volts with the brake pedal released? <p>→ Yes GO to C7.</p> <p>→ No GO to C2.</p>
C2 CHECK THE FUSE JUNCTION PANEL FUSE 15 (5A) (MOTORHOME FUSE 8 [10A])	
<p>1</p>  <p>Fuse Junction Panel Fuse 15 (5A) (Motorhome Fuse 8 [10A])</p>	
	<ul style="list-style-type: none"> Is the fuse OK?

	<p>→ Yes GO to C3.</p> <p>→ No REPLACE the fuse. TEST the system for normal operation. If the fuse fails again, CHECK for short to ground. REPAIR as necessary. TEST the system for normal operation.</p>
C3 CHECK CIRCUIT 22 (LB/BK) FOR AN OPEN	
<p>1</p> 	
<p>2</p>  <p>Brake Pedal Position (BPP) Switch C279 (Motorhome C231)</p>	
<p>3</p> 	
<p>4</p>  <p>GV1099-A</p>	<p>4 Measure the voltage between BPP switch C279-3 (motorhome C231-3), circuit 22 (LB/BK), and ground.</p>
	<p>• Is the voltage greater than 10 volts?</p> <p>→ Yes If not motorhome, GO to C4 .</p> <p>If motorhome, REPAIR circuit 810 (R/LG). TEST the system for normal operation.</p> <p>→ No</p>


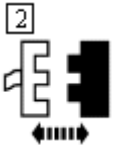
	REPAIR circuit 22 (LB/BK). TEST the system for normal operation.
C4 CHECK CIRCUIT 810 (R/LG) FOR AN OPEN	
<p>1</p>  <p>Clutch Pedal Position (CPP) Switch or Jumper C261</p>	
<p>2</p> 	<p>2 Measure the resistance between BPP switch C279-2, circuit 810 (R/LG), and CPP switch or jumper C261-3, circuit (R/LG).</p>
	<ul style="list-style-type: none"> Is the resistance less than 5 ohms? <p>→ Yes GO to C5.</p> <p>→ No REPAIR circuit 810 (R/LG). TEST the system for normal operation.</p>
C5 CHECK CIRCUIT 306 (T/LB) FOR AN OPEN	
<p>1</p> 	<p>1 Measure the resistance between CPP switch or jumper C261-4, circuit 306 (T/LB), and speed control servo C1067-4, circuit 306 (T/LB).</p>

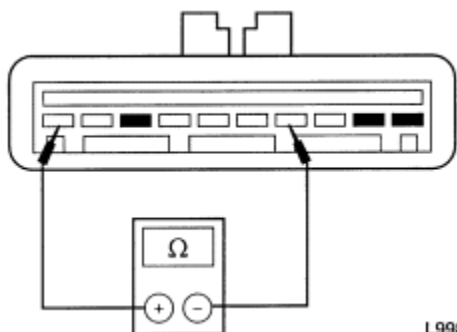
	<ul style="list-style-type: none"> • Is the resistance less than 5 ohms? <p>→ Yes GO to C6.</p> <p>→ No REPAIR circuit 306 (T/LB). TEST the system for normal operation.</p>
C6 CHECK THE CPP SWITCH	
<p>1</p>  <p>GV1098-A</p>	<p>1 Measure the resistance between CPP switch or jumper terminal 3, and terminal 4.</p>
	<ul style="list-style-type: none"> • Is the resistance less than 5 ohms? <p>→ Yes REPLACE the BPP switch; refer to Section 417-01. TEST the system for normal operation.</p> <p>→ No REPLACE the CPP switch or jumper. TEST the system for normal operation.</p>
C7 CHECK THE DEACTIVATOR SWITCH CIRCUITRY	
<p>1</p>  <p>L9981-A</p>	<p>1 Measure the voltage between speed control servo C1067-9 (motorhome C146-9), circuit 307 (BK/Y), and ground, while firmly pressing and releasing the brake pedal.</p>
	<ul style="list-style-type: none"> • Is the voltage 0 volts with the brake pedal

	<p>firmly pressed, and greater than 10 volts with the brake pedal released?</p> <p>→ Yes REPLACE the speed control servo; REFER to Actuator—Speed Control Servo. TEST the system for normal operation.</p> <p>→ No GO to C8.</p>
C8 CHECK THE DEACTIVATOR SWITCH	
<p>1</p>  <p>Deactivator Switch C102 (Motorhome C125)</p>	
<p>2</p>  <p>GV0970-A</p>	<p>2 Connect a jumper wire between deactivator switch C102 (motorhome C125), circuit 10 (LG/R), and deactivator switch C102 (motorhome C125), circuit 307 (BK/Y).</p>
<p>3</p>  <p>L9981-A</p>	<p>3 Measure the voltage between speed control servo C1067-9 (motorhome C146-9), circuit 307 (BK/Y), and speed control servo C1067-10 (motorhome C146-10), circuit 57 (BK).</p>
	<ul style="list-style-type: none"> Is the voltage greater than 10 volts? <p>→ Yes REPLACE the deactivator switch; REFER to Switch—Deactivator. TEST the system for normal</p>

	<p>operation.</p> <p>→ No GO to C9.</p>
C9 CHECK CIRCUIT 307 (BK/Y) FOR AN OPEN	
<p>1</p> 	<p>1 Measure the resistance between speed control servo C1067-9 (motorhome C146-9), circuit 307 (BK/Y), and deactivator switch C102 (motorhome C125), circuit 307 (BK/Y).</p>
	<ul style="list-style-type: none"> Is the resistance less than 5 ohms? <p>→ Yes REPAIR circuit 10 (LG/R). TEST the system for normal operation.</p> <p>→ No REPAIR circuit 307 (BK/Y). TEST the system for normal operation.</p>

PINPOINT TEST D: THE SPEED CONTROL DOES NOT DISENGAGE WHEN THE CLUTCH IS APPLIED

CONDITIONS	DETAILS/RESULTS/ACTIONS
D1 CHECK THE CLUTCH PEDAL POSITION (CPP) SWITCH CIRCUIT	
<p>1</p> 	
<p>2</p>  <p>Speed Control Servo C1067</p>	
<p>3</p>	<p>3 Measure the resistance between speed control servo C1067-4, circuit 306 (T/LB), and speed control</p>



servo C1067-10, circuit 57 (BK).

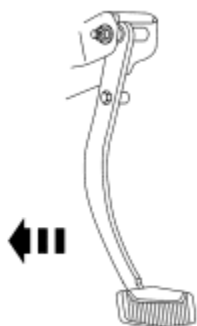
- Is the resistance less than 5 ohms?

→ **Yes**
GO to [D2](#).

→ **No**
GO to [Pinpoint Test A](#).

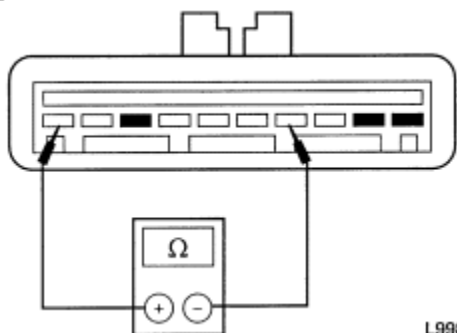
D2 CHECK THE CLUTCH SWITCH OPERATION

1



1 Depress the clutch pedal.

2





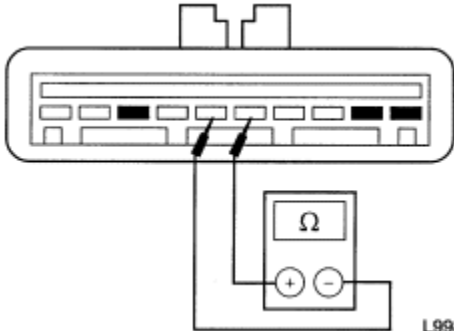
2 Measure the resistance between speed control servo C1067-4, circuit 306 (T/LB), and speed control servo C1067-10, circuit 57 (BK).

- Is the resistance greater than 10,000 ohms?

→ **Yes**
REPLACE the speed control servo; REFER to



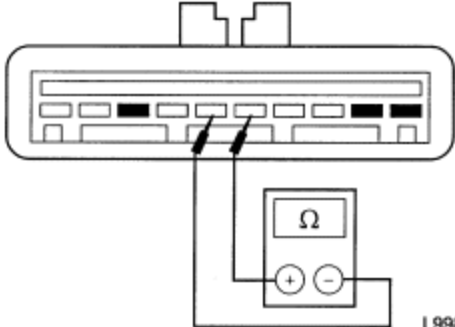
	<p>Actuator—Speed Control Servo. TEST the system for normal operation.</p> <p>→ No REPLACE the CPP switch. TEST the system for normal operation.</p>
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PINPOINT TEST E: THE COAST SWITCH IS INOPERATIVE



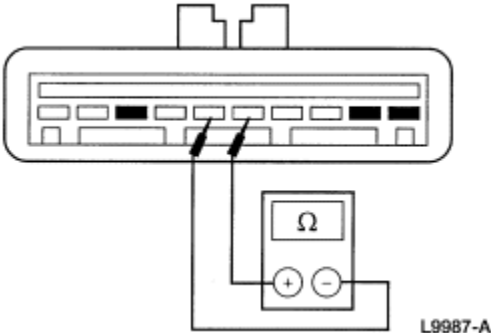
CONDITIONS	DETAILS/RESULTS/ACTIONS
E1 CHECK THE COAST SWITCH OPERATION	
<p>1</p> 	
<p>2</p>  <p>Speed Control Servo C1067 (Motorhome C146)</p>	
<p>3</p> 	<p>3 With the COAST switch depressed, measure the resistance between speed control servo C1067-5 (motorhome C146-5), circuit 151 (LB/BK), and speed control servo C1067-6 (motorhome C146-6), circuit 848 (DG/O).</p>
	<ul style="list-style-type: none"> • Is the resistance between 108 and 132 ohms? <p>→ Yes REPLACE the speed control servo; REFER to Actuator—Speed Control Servo. TEST the system for normal operation.</p> <p>→ No REPLACE the speed control actuator switch;</p>

	REFER to Switch—Speed Control Actuator . TEST the system for normal operation.
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PINPOINT TEST F: THE SET/ACCL SWITCH IS INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
F1 CHECK THE SET/ACCEL SWITCH OPERATION	
<p>1</p> 	
<p>2</p>  <p>Speed Control Servo C1067 (Motorhome C146)</p>	
<p>3</p>  <p>L9987-A</p>	<p>3 With the SET/ACCEL switch depressed and while rotating the steering wheel from stop to stop, measure the resistance between speed control servo C1067-5 (motorhome C146-5), circuit 151 (LB/BK), and speed control servo C1067-6 (motorhome C146-6), circuit 848 (DG/O).</p>
	<ul style="list-style-type: none"> Is the resistance between 612 and 748 ohms? <p>→ Yes REPLACE the speed control servo; REFER to Actuator—Speed Control Servo. TEST the system for normal operation.</p> <p>→ No REPLACE the speed control actuator switch; REFER to Switch—Speed Control Actuator. TEST the system for normal operation.</p>

PINPOINT TEST G: THE RESUME SWITCH IS INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
G1 CHECK THE RESUME SWITCH OPERATION	
<div>1</div> 	
<div>2</div>  <p>Speed Control Servo C1067 (Motorhome C146)</p>	
<div>3</div> 	<div>3</div> With the RESUME switch depressed and while rotating the steering wheel from stop to stop, measure the resistance between speed control servo C1067-5 (motorhome C146-5), circuit 151 (LB/BK), and speed control servo C1067-6 (motorhome C146-6), circuit 848 (DG/O).
	<ul style="list-style-type: none"> Is the resistance between 1980 and 2420 ohms? <p>→ Yes REPLACE the speed control servo; REFER to Actuator—Speed Control Servo. TEST the system for normal operation.</p> <p>→ No REPLACE the speed control actuator switch; REFER to Switch—Speed Control Actuator. TEST the system for normal operation.</p>

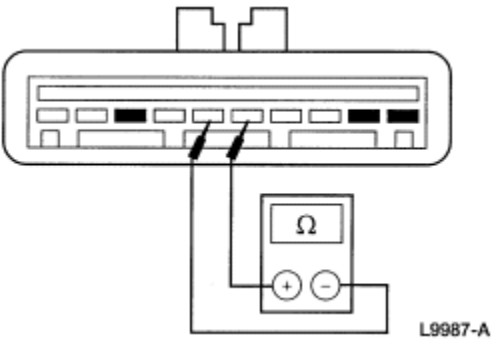
PINPOINT TEST H: THE OFF SWITCH IS INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
H1 CHECK THE OFF SWITCH OPERATION	
<div>1</div>	



Speed Control Servo C1067 (Motorhome C146)

3



3 With the OFF switch depressed and while rotating the steering wheel from stop to stop, measure the resistance between the speed control servo C1067-5 (motorhome C146-5), circuit 151 (LB/BK), and speed control servo C1067-6 (motorhome C146-6), circuit 848 (DG/O).

- Is the resistance less than 5 ohms?

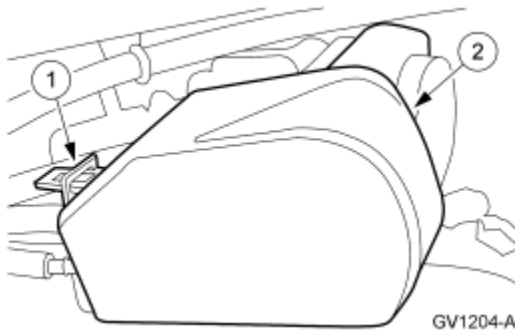
→ Yes
REPLACE the speed control servo; REFER to [Actuator—Speed Control Servo](#). TEST the system for normal operation.

→ No
REPLACE the speed control actuator switch; REFER to [Switch—Speed Control Actuator](#). TEST the system for normal operation.

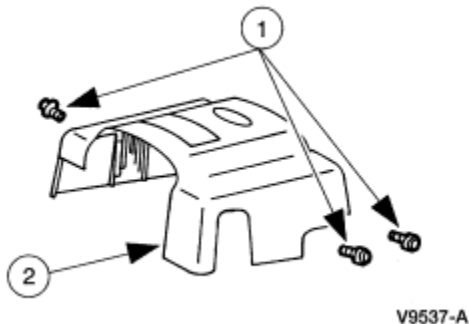
Actuator Cable—Speed Control

Removal

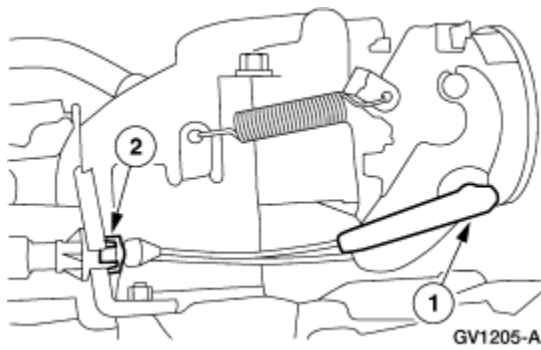
1. Remove the air cleaner outlet tube. For additional information, refer to [Section 303-12](#).
2. Remove the accelerator control splash shield (9E766) (6.8L shown).
 1. Release the tab.
 2. Remove the splash shield.



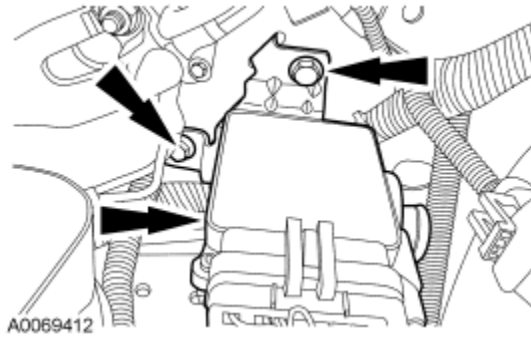
3. Remove the accelerator control splash shield (5.4L shown).
 1. Remove the bolts.
 2. Remove the splash shield.



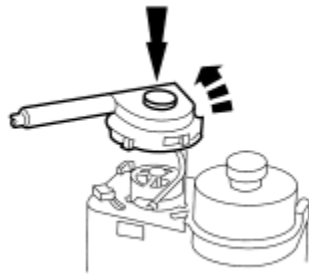
4. Disconnect the speed control actuator cable (9A825).
 1. Disconnect the speed control actuator cable from the throttle body cam and position aside.
 2. Depress the retaining clips to remove the cable from the bracket.



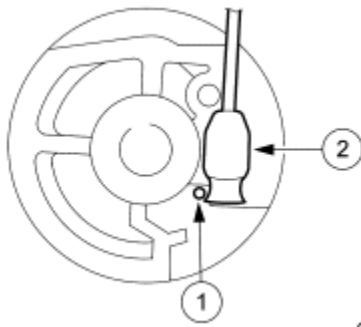
5. Remove the bolts and position the speed control actuator and bracket aside.



6. Remove the speed control actuator cable cap from the speed control servo (9C735).
 - Push in the locking arm on the speed control actuator cable cap then rotate the cap counterclockwise.



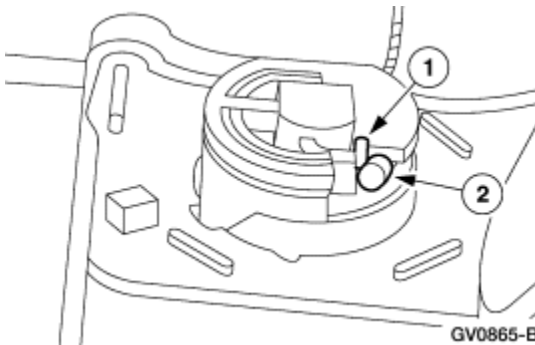
7. Disconnect the speed control core wire end from the speed control servo pulley.
 1. Depress the spring retainer.
 2. Slide the core wire end out of the speed control servo pulley.



GV1211-A

Installation

1. Insert the speed control cable slug into the speed control servo pulley slot.
 1. Gently compress the speed control servo spring.
 2. Insert the speed control cable slug into the speed control servo pulley slot.

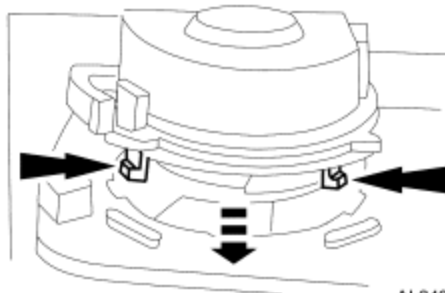


GV0865-B

2. **NOTE:** Ensure the rubber seal is fully seated onto the speed control actuator cable cap.

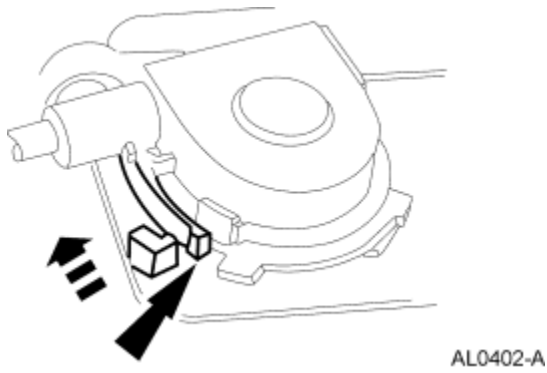
NOTE: Incorrect wrapping of the speed control actuator cable around the speed control servo pulley may result in a high idle condition.

Release the compressed spring while aligning the speed control actuator cable cap tabs with the slots in the speed control servo housing.

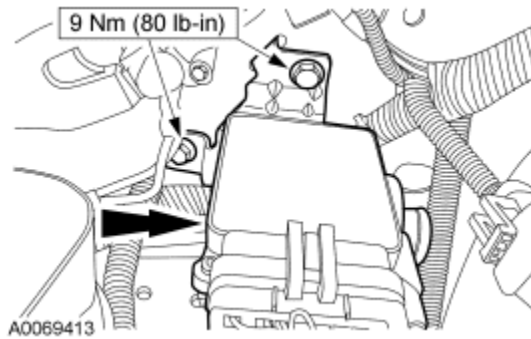


AL0401-A

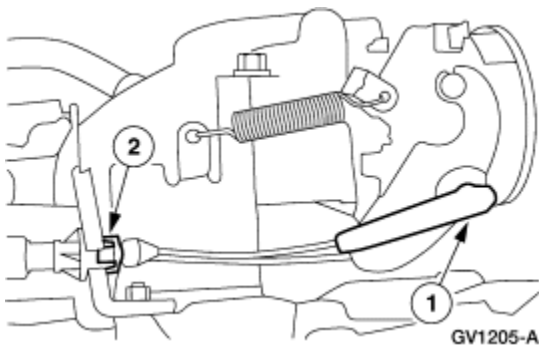
3. Rotate the speed control actuator cable cap until the locking arm engages.



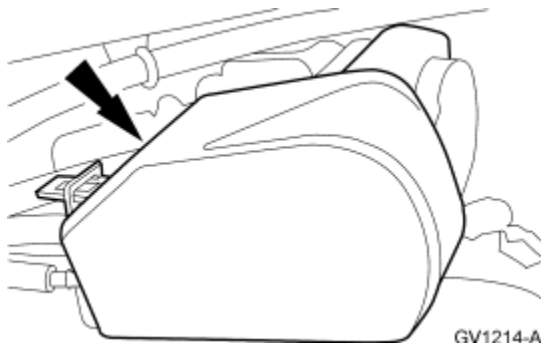
4. Position the speed control actuator and bracket and install the bolts.



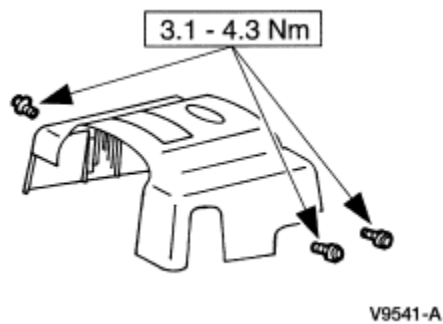
5. Connect the speed control actuator cable to the throttle body cam.
 1. Connect the speed control actuator cable to the throttle body cam by snapping it in place.
 2. Position the speed control actuator cable in the bracket.



6. Install the accelerator control splash shield (5.8L shown).



7. Install the accelerator control splash shield (5.4L shown).

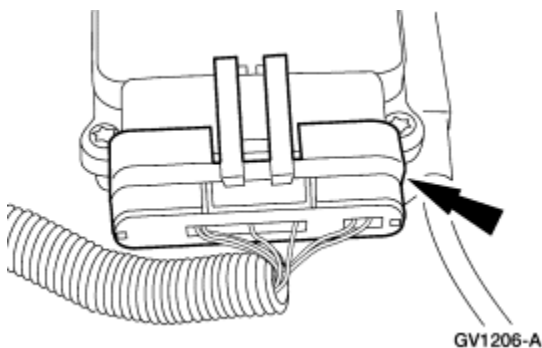


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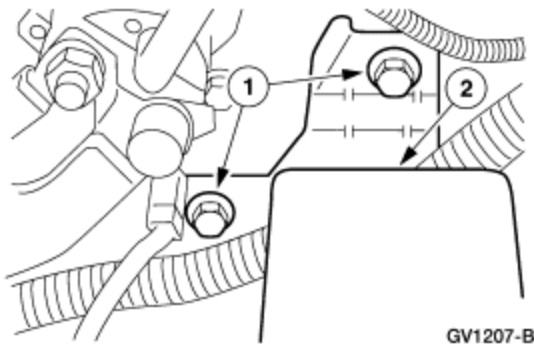
Actuator—Speed Control Servo

Removal

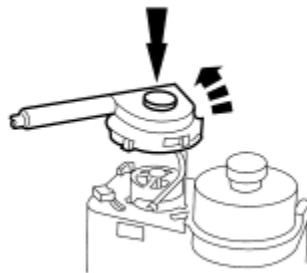
1. Disconnect the speed control servo electrical connector.



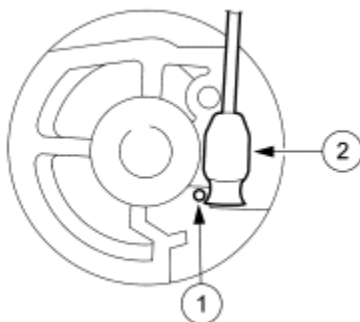
2. Remove the speed control servo and bracket.
 1. Remove the bolts.
 2. Remove the speed control servo and bracket.



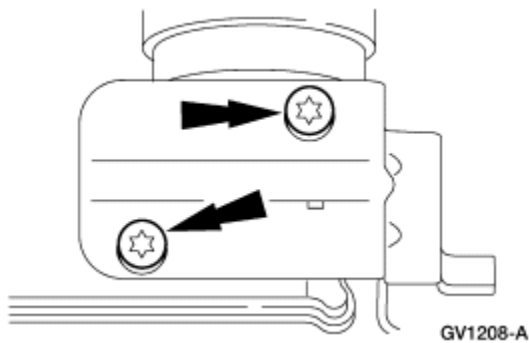
3. Remove the speed control actuator cable cap from the speed control servo.
 - Push in the locking arm on the speed control actuator cable cap and rotate the cap counterclockwise.



4. Disconnect the speed control core wire from the speed control servo pulley.
 1. Depress the spring retainer.
 2. Slide the core wire end out of the speed control servo pulley.

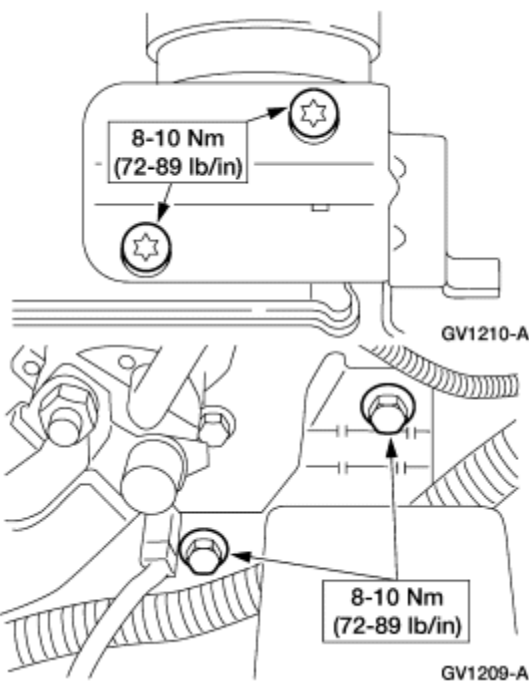


5. Remove the speed control servo bracket.
 1. Remove the screws.
 2. Remove the speed control servo bracket.



Installation

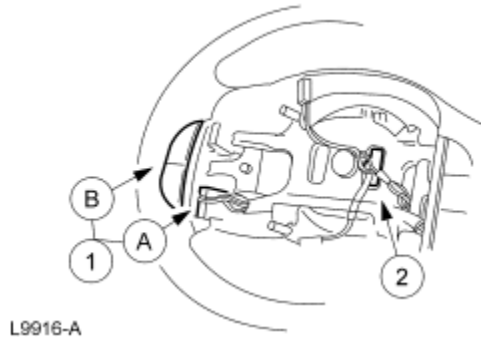
1. To install, reverse the removal procedure.



Switch—Speed Control Actuator

Removal

1. Remove the driver side air bag module (043B13). For additional information, refer to [Section 501-20B](#).
2. Remove the speed control actuator switch (9C888).
 1. Release the four (A) speed control actuator switch clips and remove the (B) speed control actuator switch.
 2. Disconnect the speed control actuator switch electrical connector.





Installation

1. To install, reverse the removal procedure.

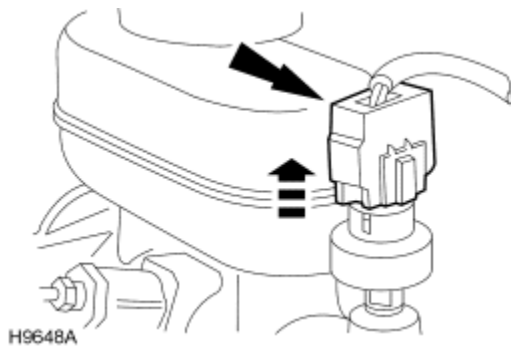
Switch—Deactivator

Removal

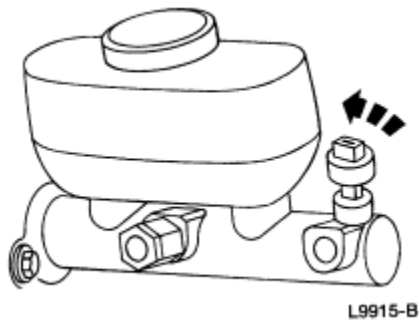
1.  **WARNING:** Brake fluid contains polyglycol ethers and polyglycols. Avoid contact with eyes. Wash hands thoroughly after handling. If brake fluid contacts eyes, flush eyes with running water for 15 minutes. Get medical attention if irritation persists. If taken internally, drink water and induce vomiting. Get medical attention immediately.
-  **CAUTION:** Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

Disconnect the battery ground cable.

2. Disconnect the deactivator switch electrical connector.



3. Remove the deactivator switch.

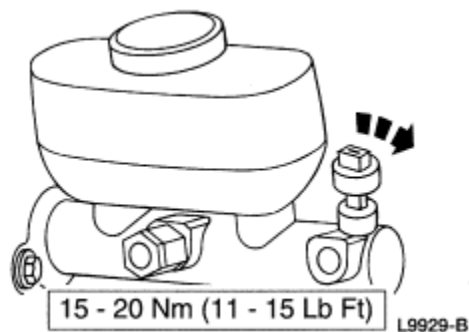


Installation

1. **NOTE:** When the battery is disconnected and reconnected, some abnormal drive symptoms may occur while the vehicle relearns its adaptive strategy. The vehicle may need to be driven 16 km (10 mi) or more to relearn the strategy.

NOTE: After the deactivator switch is installed, it is necessary to bleed the brake system. For additional information, refer to [Section 206-00](#).

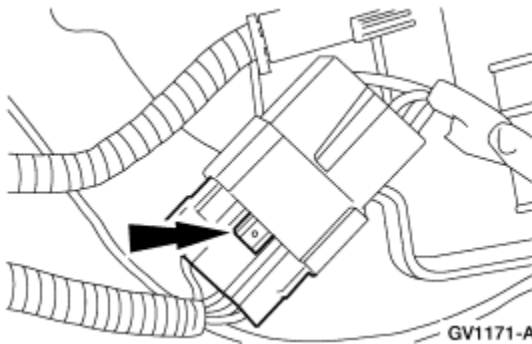
To install, reverse the removal procedure.



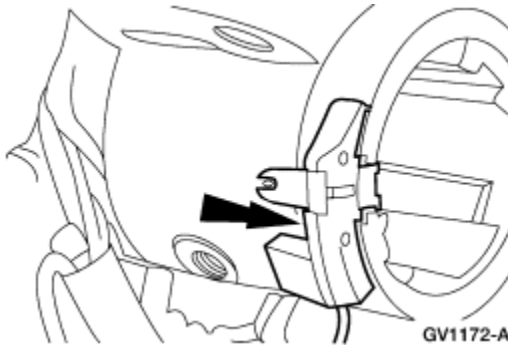
Brush Assembly

Removal

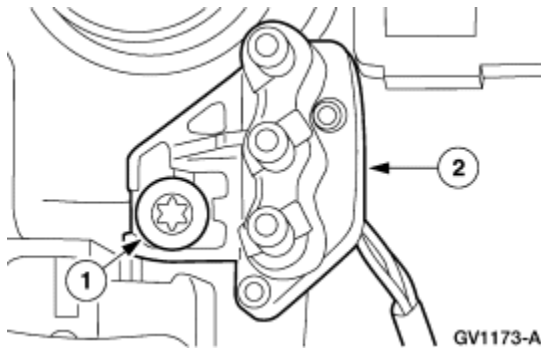
1. Remove the steering wheel. For additional information, refer to [Section 211-04](#).
2. Remove the steering column shrouds. For additional information, refer to [Section 211-04](#).
3. Disconnect the brush assembly electrical connector.



4. Remove the key in ignition warning switch.

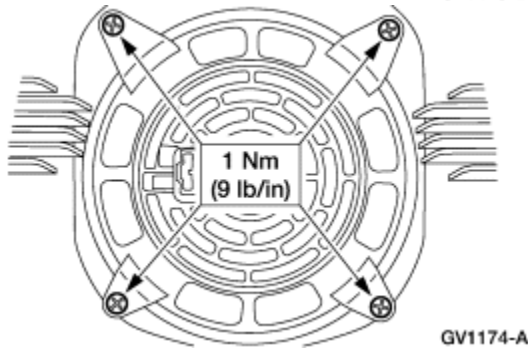
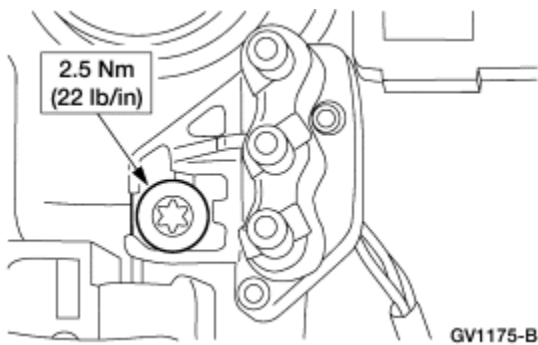


5. Remove the brush assembly.
 1. Remove the screw.
 2. Remove the brush assembly.



Installation

1. To install, reverse the removal procedure.



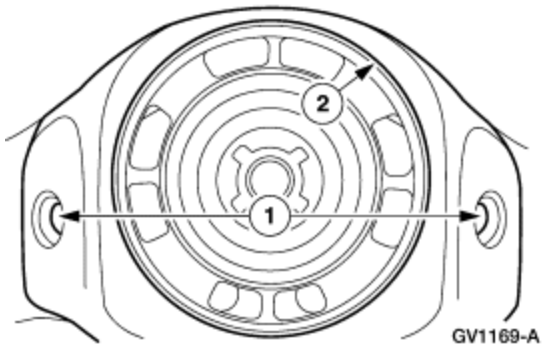
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Brush Assembly—Control and Spring

Removal

1. Remove the steering wheel. For additional information, refer to [Section 211-04](#).
2. Remove the steering wheel cover.
 1. Remove the steering wheel cover screws.

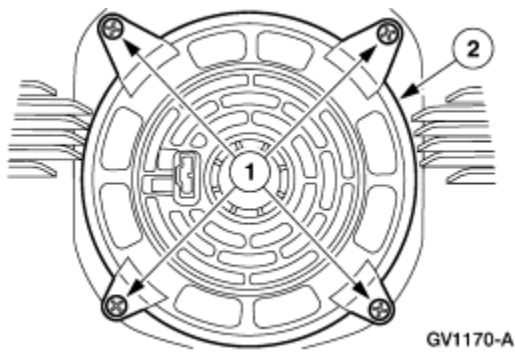
2. Remove the steering wheel cover.



3. Remove the brush control and spring.

1. Remove the screws.

2. Remove the control and spring.



Installation

1. To install, reverse the removal procedure.

